TRANSCRIPT OF RECORD.

SUPREME COURT OF THE UNITED STATES.

OCTOBER TERM, 1908.

No. [redacted] 3

THE AMERICAN SUGAR REFINING COMPANY OF NEW YORK, APPELLANT,

vs.

THE UNITED STATES.

APPEAL FROM THE CIRCUIT COURT OF THE UNITED STATES FOR THE SOUTHERN DISTRICT OF NEW YORK.

FILED MAY 2, 1908.

(20,237.)

(20,237.)

SUPREME COURT OF THE UNITED STATES

OCTOBER TERM, 1906.

No. 281.

THE AMERICAN SUGAR REFINING COMPANY OF NEW YORK, APPELLANT;

vs.

THE UNITED STATES.

APPEAL FROM THE CIRCUIT COURT OF THE UNITED STATES FOR THE SOUTHERN DISTRICT OF NEW YORK.

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1 At a Stated Term of the United States Circuit Court for the Southern District of New York, held in the United States Court House and Post Office Building, in the City of New York, on the 24th day of January, 1905.

Present: Hon. E. Henry Lacombe, Circuit Judge.

Order.

In the Matter of the Application of THE AMERICAN SUGAR REFINING COMPANY OF NEW YORK for a Review of the Decisions of the Board of General Appraisers as to the Rate and Amount of Duty on Certain Merchandise Imported by said Company per Myrtledene and Other Vessels. No. 3825.

On reading and filing the petition herein, it is on motion of Parsons, Closson & McIlvaine, attorneys for the above named petitioner,

Ordered, that the Board of United States General Appraisers at the Port of New York return to this Court the record and evidence taken by them in each of the matters specified in said petition, together with certified statements of the facts involved in such matters and their decisions thereon.

E. H. LACOMBE,
U. S. Circuit Judge.

2 *Bond.*

United States Circuit Court for the Southern District of New York.

In the Matter of the Application of THE AMERICAN SUGAR REFINING COMPANY OF NEW YORK for a Review of the Decisions of the Board of General Appraisers as to the Rate and Amount of Duty on Certain Merchandise Imported by said Company per Myrtledene and Other Vessels.

Know all men by these present, that I, John A. Sherer, of the City of New York, am held and firmly bound unto the United States of America, in the sum of one hundred dollars, to be paid to the said United States of America, for the payment of which, well and truly to be made, I bind myself and my heirs, executors and administrators.

Sealed with my seal and dated the 20th day of January, 1905.

Whereas the above named The American Sugar Refining Company of New York has applied, or will apply, to the Circuit Court of the United States for the Southern District of New York for a review of the questions of law and fact involved in the decision of the Board of United States General Appraisers at the port of New York upon the entry of certain merchandise as above mentioned.

3 Now, therefore, the condition of this obligation is such, that if the above named applicant shall prosecute said matter, application or proceeding to effect and pay all damages and costs, if he shall fail to make said matter, application or proceeding good, then his obligation shall be void; otherwise the same shall be and remain in full force and virtue.

Sealed and delivered and taken and acknowledged before me this 20th day of January, 1905.

JOHN A. SHERER. [L. S.]

UNITED STATES OF AMERICA,
Southern District of New York, ss:

On the 20th day of January, 1905, before me personally appeared John A. Sherer, to me known to be the individual who executed the above bond, who, being by me duly sworn, deposes and says, that he is a resident of the Eastern District of New York, and that he is worth the sum of two hundred dollars ($200) over and above all his debts and liabilities, and duly acknowledged that he executed the same.

[SEAL.] ALBERT S. WRIGHT,
Notary Public, N. Y. Co.

Approved.
E. H. LACOMBE,
U. S. Circuit Judge.

4 Circuit Court of the United States for the Southern District of New York.

Petition.

In the Matter of the Application of THE AMERICAN SUGAR REFINING COMPANY OF NEW YORK for a Review of the Decisions of the Board of General Appraisers as to the Rate and Amount of Duty on Certain Merchandise Imported by said Company per Myrtledene and Other Vessels. No. —.

To the Honorable the Circuit Court of the United States for the Southern District of New York:

Your petitioner is a corporation, duly organized and existing under the laws of the State of New York, engaged in business as such at the port of New York.

Your petitioner being dissatisfied with the decisions made upon the dates mentioned in the schedule hereto annexed by the Board of General Appraisers sustaining the decisions of the Collector of Customs as to the construction of the law and the facts respecting the classification of, and as to the rates of duty imposed thereunder upon, certain merchandise, to wit, the importations of sugars imported per the ships entered respectively by your petitioner on the dates and per the entry numbers set forth in the schedule hereto annexed, respectfully makes application to this Court for a review of

the questions of law and fact involved in each of such decisions rendered under the said respective dates, and hereby makes
5 the following concise statement of the errors of law and fact complained of, to wit:

The said merchandise imported as above was classified and assessed for duty as sugar testing by the polariscope, the number of degrees shown by so-called and pretended polariscopic tests thereof reported to the Collector by the United States Appraiser, and the entries thereof were liquidated accordingly.

Your petitioner being dissatisfied with the decisions assessing duties as aforesaid, gave notice in each case within ten days after said liquidation and ascertainment of duty, setting forth the reason of its objection thereto in each case, to wit, that the so-called and pretended polariscopic tests upon which the said liquidations were based were in each case the polariscopic test of the sugar increased in each case by certain additions made thereto in pursuance only of certain regulations promulgated by the Secretary of the Treasury on October 27th, 1897, and again on February 17th, 1899, which regulations in so far as they require the making of such additions are illegal and void and contrary to the laws and the Constitution of the United States. By reason of the classification of the said sugars as sugars testing by polariscope the number of degrees shown by the polariscopic test plus the addition in question, your petitioner was in each case required to pay duty in excess of that which would have been payable upon the sugar had it been classified in accordance with its polariscopic test without such increase by the amount shown in the schedule hereto annexed. The total of the additional duties thus exacted of your petitioner in said cases is over $5,600. Whereupon the invoices and all papers and exhibits connected therewith were in each of the said cases duly transmitted to the said Board of General Appraisers, which Board proceeding to hear and determine
6 the questions of law and fact involved, sustained all of the Collector's said decisions in the premises.

And for the errors of law and fact in each of the decisions aforesaid of the Board in this regard herein complained of, your petitioner states that the said Board were in error.

I. In not holding that the addition to the number of degrees shown by the polariscopic test of said sugars of a certain percentage as a so-called correction for temperature, was and is an addition to the polariscopic test prescribed by the Act of Congress, known as the Tariff Act of July 24th, 1897; and in not holding that such addition was and is, therefore, the imposition of an additional tax on said sugars, by the Secretary of the Treasury, in violation of the provisions of the statutes and Constitution of the United States.

II. In not holding that the Act of Congress by the phrases "testing by the polariscope" and "polariscopic test" intended that the words should have the same meaning which had been attributed both by the trade and by the Treasury Department itself to the same words when used in the previous Tariff Act of March 3rd, 1883.

III. In not holding that the Act of Congress in question by the phrases "testing by the polariscope" and "polariscopic test" intended

the same polariscopic test which was then actually in force under the then existing regulations of the Treasury Department with reference to the ascertainment of duties upon imported sugars, and which had been in force under the regulations of the Treasury Department promulgated under the said prior Act of March 3rd, 1883, under date of May 22nd, 1883, in which prior act the same language had been employed, and which was the only polariscopic test which
7 was then or had ever been in use by the Treasury Department in classifying or determining the rate and amount of duties upon imported sugars; and which was and is the only polariscopic test known to the trade.

IV. In holding that any increase of temperature occurring in actual practice reduces the rotatory power of the sugar solution in the polariscope or otherwise produces a lower test than that which would be obtained at any lower temperature occurring in actual practice.

V. In holding that the assertion of some experts and the denial by others of the existence of any such alleged influence of temperature upon the rotatory power of sugar justifies the Secretary of the Treasury in requiring additions to be made to the observed polariscopic test of imported sugars prescribed by law; and so increasing the rate of duty payable upon them above that prescribed by law.

VI. In holding that the polariscopic test means "the percentage of pure sucrose contained in sugar as ascertained by polarimetric estimation."

VII. In holding that under the existing regulations of the Treasury Department "the percentage of pure sucrose contained in sugar" is ascertained; either absolutely, or more approximately than by the polariscopic test itself.

VIII. In holding that under the existing regulations of the Treasury Department "the percentage of pure sucrose contained in sugar," or anything else, is "ascertained by polarimetric estimation;" and in not holding that under such regulations whatever is ascertained is ascertained only in part by polarimetric estimation and in part by an arithmetrical process of an addition to the tests shown by the polariscope of a self-styled "correction."
8 IX. In holding that the regulations promulgated by the Secretary of the Treasury under date of October 27th, 1897, or the revised regulations promulgated by him under date of February 17th, 1899, in conformity with which such sugars were tested, are reasonable regulations or are authorized by the laws or Constitution of the United States, in so far as they require additions to be made to the observed polariscopic test of sugar or prescribe a polariscopic test different in any way from that theretofore and then and now in use by the trade and prescribed both by the Treasury regulations of May 13th, 1895, which regulations were in force at the time of the passage of the Tariff Act in question, and the Treasury regulations promulgated by the Treasury Department under date of May 22nd, 1883, under the Tariff Act of March 3rd, 1883.

Accordingly your petitioner respectfully prays this Court to order the said Board of General Appraisers to return to this Court the

record and evidence taken by the said Board, together with a certified statement of the facts involved in each of the said cases mentioned in the schedule hereto annexed, and of their decisions respectively thereon, and thereupon to proceed to review said decisions and to determine the questions of law and fact involved in each and every of said cases.

AMERICAN SUGAR REFINING COMPANY
OF NEW YORK,
By C. R. HEIDE, *Secretary.*
PARSONS, CLOSSON & McILVAINE,
Attorneys for Petitioner.
52 William Street, New York City, N. Y.

9 SCHEDULE.

The American Sugar Refining Company of New York.

Protest.	Vessel.	Date.	Entry number.	Additional duty.
23402	Myrtledene	June 27/04	131932	$1,028.95
24830	Fontebelle	Aug. 31/04	178669	389.25
24864	Pennsylvania	July 28/04	155380	620.16
25343	Viscania	Aug. 10/04	163427	235.38
25465	Straits of Dover	July 22/04	150708	595.03
25824	Falk	Aug. 24/04	173549	628.42
26156	Nile	Aug. 10/04	168284	258.91
26157	Hermia	Aug. 10/04	163426	323.87
26158	Monterey	Aug. 13/04	165775	267.33
26213	Frey	Aug. 29/04	176310	945.00
21453	Frey	June 20/04	127150	336.42
				$5,628.72

10 *Return.*

In the Circuit Court of the United States for the Southern District of New York.

In the Matter of THE AMERICAN SUGAR REFINING COMPANY OF NEW YORK *versus* UNITED STATES, Being an Appeal from a Decision of the Board of United States General Appraisers. Suit No. 3825.

Return of the Board of United States General Appraisers to the Order of Hon. E. Henry Lacombe, United States Circuit Judge.

Dated New York, Apr. 24, 1905.

The Board of United States General Appraisers, sitting at New York, in response to the order of the Court in the above matter, make the folowing return of the record and evidence taken by them in the above matter, and of the facts involved therein, as ascertained by them.

This return comprises:

(1) The protests enumerated in the importers' petition, Nos. 134269, 142315, 142320, 142321, 142326, 142327, 142328, 142329, 142330, 142331 and 142333, which are marked, respectively, Exhibits A, B, C, D, E, F, G, H, I, J and K.

(2) The copies of the reports of the collector of customs,
11 relative to said protests, which are two in number, and are marked, respectively, Exhibits L and M.

(3) A copy of the decision of the Board, marked Exhibit N.

EXHIBIT A, SUIT 3825.

NEW YORK, *Aug.* 31, 1904.

To the Collector of Customs, Port of New York.

SIR: We hereby protest against your decision as to the rate and amount of duty exacted by you on 30,000 packages of sugar imported per s/s Frey on the 20 day June, 1904, Entry No. 127150 for the reasons following, to wit:

1. Said classification and assessment are based upon the Appraiser's return of the polariscopic test of said sugar (which is below No. 16 Dutch Standard in Color), which test and return are erroneous and excessive, owing to an erroneous and incorrect method of testing the same by the polariscope as prescribed by the regulations of the Treasury.

2. The law requires that the duty on sugar not above No. 16 Dutch Standard in Color shall be assessed at certain rates according to the polariscopic test thereof, by which is meant and understood to be the usual commercial polariscope test recognized and accepted in trade between buyer and seller as ascertained by methods and instruments used by chemists engaged in the business of testing sugar, being methods in general use by sugar chemists, manufacturers and refiners at the time of the existing tariff act.

3. That the method of testing sugar by the polariscope
12 prescribed by the Secretary of the Treasury, and which method was used by the Appraising officers in respect to the sugar in question is not the usual commercial method referred to, but differs therefrom in essential particulars, and has resulted in erroneous and excessive tests and the consequent exaction of excessive and illegal duties upon said sugar.

THE AMERICAN SUGAR REFINING CO.
OF NEW YORK,
By W. A. DENISON, *Attorney*, 117 *Wall St.*

Liquidated Aug. 29/04.

(Endorsed:) 21453. The American Sugar Ref'g Co. Frey Sugar. 134269.

Custom House, New York. Aug. 31, 1904. Received.

	Ent.	Liq.	Pro.
Vessel.	1904.	1904.	1904.
Frey.	Jun- 20.	Aug. 29.	Aug. 31.

EXHIBIT B, SUIT 3825.

NEW YORK, *Sept.* 26, 1904.

To the Collector of Customs, Port of New York.

SIR: We hereby protest against your decision as to the rate and amount of duty exacted by you on 26300 packages of sugar imported per ss. Myrtledene on the 27th day of June, 1904. Entry No. 131932 for the reasons following, to wit:

1. Said classification and assessment are based upon the Appraiser's return of the polariscopic test of said sugar (which
13 is below No. 16 Dutch Standard in Color), which test and return are erroneous and excessive, owing to an erroneous and incorrect method of testing the same by the polariscope as prescribed by the regulations of the Treasury.

2. The law requires that the duty on sugar not above No. 16 Dutch Standard in Color shall be assessed at certain rates according to the polariscopic test thereof, by which is meant and understood to be the usual commercial polariscopic test recognized and accepted in trade between buyer and seller as ascertained by methods and instruments used by chemists engaged in the business of testing sugar, being methods in general use by sugar chemists, manufacturers and refiners at the time of the existing tariff act.

3. That the method of testing sugar by the polariscope prescribed by the Secretary of the Treasury, and which method was used by the Appraising officers in respect to the sugar in question is not the usual commercial method referred to, but differs therefrom in essential particulars, and has resulted in erroneous and excessive tests and the consequent exaction of excessive and illegal duties upon said sugar.

THE AMERICAN SUGAR REFINING CO.
OF NEW YORK.
By W. A. DENISON, *Attorney*, 117 *Wall St.*

Liquidated Sept. 22/04.

(Endorsed:) 23402. The American Sugar Ref'g Co. Myrtledene. All Sugar Test.
142315. Custom House, New York. Sep. 26, 1904. Received.

C. Vessel.	Ent. 1904.	Liq. 1904.	Pro. 1904.
Myrtledene.	Jun- 28.	Sep. 22.	Sep. 26.

14 EXHIBIT C, SUIT 3825.

NEW YORK, *Oct.* 12, 1904.

To the Collector of Customs, Port of New York.

SIR: We hereby protest against your decision as to the rate and amount of duty exacted by you on 10,522 packages of sugar imported

per s/s Fontabelle on the 31 day of Aug. 1904, Entry No. 178669, for the reasons following, to wit:

1. Said classification and assessment are based upon the Appraiser's return of the polariscopic test of said sugar (which is below No. 16 Dutch Standard in Color), which test and return are erroneous and excessive, owing to an erroneous and incorrect method of testing the same by the polariscope as prescribed by the regulations of the Treasury.

2. The law requires that the duty on sugar not above No. 16 Dutch Standard in Color shall be assessed at certain rates according to the polariscopic test thereof, by which is meant and understood to be the usual commercial polariscopic test recognized and accepted in trade between buyer and seller as ascertained by methods and instruments used by chemists engaged in the business of testing sugar, being methods in general use by sugar chemists, manufacturers and refiners at the time of the existing tariff act.

3. That the method of testing sugar by the polariscope prescribed by the Secretary of the Treasury, and which method was used by the Appraising officers in respect to the sugar in question, is not the usual commercial method referred to, but differs therefrom in essential particulars, and has resulted in erroneous and excessive tests and the consequent exaction of excessive and illegal duties upon said sugar.

THE AMERICAN SUGAR REFINING CO.
OF NEW YORK,
By W. A. DENISON, *Attorney*, 117 *Wall St.*

Liquidated, Oct. 8/04.

(Endorsed:)—24830—142320—The American Ref'g Co.—Fontabelle—Sugar.

Custom House, New York, Oct. 12, 1904. Received.

C.	Vessel.	Ent. 1904.	Liq. 1904.	Pro. 1904.
	Fontabelle.	Aug. 31.	Oct. 8.	Oct. 12.

EXHIBIT D, SUIT 3825.

NEW YORK, *Oct.* 12, 1904.

To the Collector of Customs, Port of New York.

SIR: We hereby protest against your decision as to the rate and amount of duty exacted by you on 30,483 packages of sugar imported per ss. Pennsylvania on the 28th day July, 1904. Entry No. 155,380 for the reasons following, to wit:

1. Said classification and assessment are based upon the Appraiser's return of the polariscopic test of said sugar (which is below No. 16 Dutch Standard in Color) which test and return are erroneous and excessive, owing to an erroneous and incorrect method

of testing the same by the polariscope as prescribed by the regulations of the Treasury.

16 2. The law requires that the duty on sugar not above No. 16 Dutch Standard in Color shall be assessed at certain rates according to the polariscopic test thereof, by which is meant and understood to be the usual commercial polariscopic test recognized and accepted in trade between buyer and seller as ascertained by methods and instruments used by chemists engaged in the business of testing sugar, being methods in general use by sugar chemists, manufacturers and refiners at the time of the existing Tariff Act.

3. That the method of testing sugar by the polariscope prescribed by the Secretary of the Treasury, and which method was used by the Appraising officers in respect to the sugar in question is not the usual commercial method referred to, but differs therefrom in essential particulars, and has resulted in erroneous and excessive tests and the consequent exaction of excessive and illegal duties upon said sugar.

THE AMERICAN SUGAR REFINING CO.
OF NEW YORK,
By W. A. DENISON, *Attorney*, 117 *Wall St.*

Liquidated Oct. 7/04.

(Endorsed:)—24864—142321. The American Sugar Ref'g Co. Penna. Sugar.
Custom House, New York, Oct. 13, 1904. Received.

C.	Vessel.	Ent.	Liq.	Pro.
	1904.	1904.	1904.	1904.
	Penna.	Jul. 29.	Oct. 7.	Oct. 13.

17 EXHIBIT E, SUIT 3825.

NEW YORK, *Oct.* 18, 1904.

To the Collector of Customs, Port of New York.

SIR: We hereby protest against your decision as to the rate and amount of duty exacted by you on 9,275 packages of sugar imported per s/s Vigilancia on the 10 day of Aug., 1904, Entry No. 163,427, for the reasons following, to wit:

1. Said classification and assessment are based upon the Appraiser's return of the polariscopic test of said sugar (which is below No. 16 Dutch Standard in Color), which test and return are erroneous and excessive, owing to an erroneous and incorrect method of testing the same by the polariscope as prescribed by the regulations of the Treasury.

2. The law requires that the duty on sugar not above No. 16 Dutch Standard in Color shall be assessed at certain rates according to the polariscopic test thereof, by which is meant and understood

to be the usual commercial polariscopic test recognized and accepted in trade between buyer and seller as ascertained by methods and instruments used by chemists engaged in the business of testing sugar, being methods in general use by sugar chemists, manufacturers and refiners at the time of the existing tariff act.

3. That the method of testing sugar by the polariscope prescribed by the Secretary of the Treasury, and which method was used by the Appraising officers in respect to the sugar in question is not the usual commercial method referred to, but differs therefrom in essential particulars, and has resulted in erroneous and excessive
18 tests and the consequent exaction of excessive and illegal duties upon said sugar.

THE AMERICAN SUGAR REFINING CO.
OF NEW YORK,
By W. A. DENISON, *Attorney*, 117 *Wall St.*

Liquidated Oct. 15/04.

(Endorsed:)—25343—142326. The American Sugar Ref'g Co.—Vigilancia—Sugar.
Custom House, New York, Oct. 18, 1904. Received.

C.	Vessel.	Ent. 1904.	Liq. 1904.	Pro. 1904.
	Vigilancia.	Aug. 13.	Oct. 15.	Oct. 18.

EXHIBIT F, SUIT 3825.

NEW YORK, *Oct.* 18, 1904.

To the Collector of Customs, Port of New York.

SIR: We hereby protest against your decision as to the rate and amount of duty exacted by you on 17321 packages of sugar imported per s/s. s/o Dover on the 22 day of July, 1904, Entry No. 150708 for the reasons following, to wit:

1. Said classification and assessment are based upon the Appraiser's return of the polariscopic test of said sugar (which is below No. 16 Dutch Standard in Color), which test and return are erroneous and excessive, owing to an erroneous and incorrect method of testing the same by the polariscope as prescribed by the regulations of the Treasury.

19 2. The law requires that the duty on sugar not above No. 16 Dutch Standard in Color shall be assessed at certain rates according to the polariscopic test thereof, by which is meant and understood to be the usual commercial polariscopic test recognized and accepted in trade between buyer and seller as ascertained by methods and instruments used by chemists engaged in the business of testing sugar, being methods in general use by sugar chemists, manufacturers and refiners at the time of the existing tariff act.

3. That the method of testing sugar by the polariscope prescribed by the Secretary of the Treasury, and which method was used by

the Appraising officers in respect to the sugar in question is not the usual commercial method referred to, but differs therefrom in essential particulars, and ha resulted in erroneous and excessive tests and the consequent exaction of excessive and illegal duties upon said sugar.

THE AMERICAN SUGAR REFINING CO.
OF NEW YORK,
By W. A. DENISON, *Attorney*, 117 *Wall St.*

Liquidated Oct. 15/04.

(Endorsed:)—25465. The American Sugar Ref'g Co. Sts. of Dover. Sugar. 142327.

Custom House, New York, Oct. 19, 1904. Received.

C.	Vessel.	Ent. 1904.	Liq. 1904.	Pro. 1904.
	Straits of Dover.	Jul. 22.	Oct. 15.	Oct. 19.

20 EXHIBIT G, SUIT 3825.

NEW YORK, *Oct.* 24, 1904.

To the Collector of Customs, Port of New York.

SIR: We hereby protest against your decision as to the rate and amount of duty exacted by you on 20490 packages of sugar imported per s/s Falk, on the 24 day Aug., 1904. Entry No. 173349 for the reasons following, to wit:

1. Said classification and assessment are based upon the Appraiser's return of the polariscopic test of said sugar (which is below No. 16 Dutch Standard in Color), which test and return are erroneous and excessive, owing to an erroneous and incorrect method of testing the same by the polariscope as prescribed by the regulations of the Treasury.

2. The law requires that the duty on sugar not above No. 16 Dutch Standard in Color shall be assessed at certain rates according to the polariscopic test thereof, by which is meant and understood to be the usual commercial polariscopic test recognized and accepted in trade between buyer and seller as ascertained by methods and instruments used by chemists engaged in the business of testing sugar, being methods in general use by sugar chemists, manufacturers and refiners at the time of the existing tariff act.

3. That the method of testing sugar by the polariscope prescribed by the Secretary of the Treasury, and which method was used by the Appraising officers in respect to the sugar in question is not the usual commercial method referred to, but differs therefrom in essential particulars, and has resulted in erroneous and excessive
21 tests and the consequent exaction of excessive and illegal duties upon said sugar.

THE AMERICAN SUGAR REFINING CO.
OF NEW YORK,
By W. A. DENISON, *Attorney*, 117 *Wall St.*

Liquidated, Oct. 24, '04.

(Endorsed:) 142328—25824. The American Sugar Ref'g Co.—Falk.—Sugar.
Custom House, New York, Oct. 24, 1904. Received.

C.	Vessel.	Ent. 1904.	Liq. 1904.	Pro. 1904.
	Falk.	Aug. 24.	Oct. 20.	Oct. 24.

EXHIBIT H, SUIT 3825.

NEW YORK, *Oct.* 26, 1904.

To the Collector of Customs, Port of New York.

SIR: We hereby protest against your decision as to the rate and amount of duty exacted by you on 9170 packages of sugar imported per s/s Nile on the 10 day Aug., 1904, Entry No. 168284, for the reasons following, to wit:

1. Said classification and assessment are based upon the Appraiser's return of the polariscopic test of said sugar (which is below No. 16 Dutch Standard in Color), which test and return are erroneous and excessive, owing to an erroneous and incorrect method of testing the same by the polariscope as prescribed by the regulations of the Treasury.

22 2. The law requires that the duty on sugar not above No. 16 Dutch Standard in Color shall be assessed at certain rates according to the polariscopic test thereof, by which is meant and understood to be the usual commercial polariscope test recognized and accepted in trade between buyer and seller as ascertained by methods and instruments used by chemists engaged in the business of testing sugar, being methods in general use by sugar chemists, manufacturers and refiners at the time of the existing tariff act.

3. That the method of testing sugar by the polariscope prescribed by the Secretary of the Treasury, and which method was used by the Appraising officers in respect to the sugar in question is not the usual commercial method referred to, but differs therefrom in essential particulars, and has resulted in erroneous and excessive tests and the consequent exaction of excessive and illegal duties upon said sugar.

THE AMERICAN SUGAR REFINING CO.
OF NEW YORK,
By W. A. DENISON, *Attorney,* 117 *Wall St.*

Liquidated Oct. 22/04.

(Endorsed:) 26156. The American Sugar Ref'g Co. 143329. Nile. Sugar.
Custom House, New York, Oct. 28, 1904, received.

C.	Vessel.	Ent. 1904.	Liq. 1904.	Pro. 1904.
	Nile.	Aug. 17.	Oct. 22.	Oct. 28.

23 EXHIBIT I, SUIT 3825.

NEW YORK, *Oct.* 26, 1904.

To the Collector of Customs, Port of New York.

SIR: We hereby protest against your decision as to the rate and amount of duty exacted by you on 10,000 packages of sugar imported per s/s Hermia on the 10 day Aug. 1904. Entry No. 163426, for the reasons following, to wit:

1. Said classification and assessment are based upon the Appraiser's return of the polariscopic test of said sugar (which is below No. 16 Dutch Standard in Color), which test and return are erroneous and excessive, owing to an erroneous and incorrect method of testing the same by the polariscope as prescribed by the regulations of the Treasury.

2. The law requires that the duty on sugar not above No. 16 Dutch Standard in Color shall be assessed at certain rates according to the polariscopic test thereof, by which is meant and understood to be the usual commercial polariscopic test recognized and accepted in trade between buyer and seller as ascertained by methods and instruments used by chemists engaged in the business of testing sugar, being methods in general use by sugar chemists, manufacturers and refiners at the time of the existing tariff act.

3. That the method of testing sugar by the polariscope prescribed by the Secretary of the Treasury, and which method was used by the Appraising officers in respect to the sugar in question is not the usual commercial method referred to, but differs therefrom in essential particulars, and has resulted in erroneous and excessive
24 tests and the consequent exaction of excessive and illegal duties upon said sugar.

THE AMERICAN SUGAR REFINING CO.
OF NEW YORK,
By W. A. DENISON, *Attorney*, 117 *Wall St.*

Liquidated Oct. 22, '04.

(Endorsed:) 142330—26157. The American Sugar Ref'g Co. Hermia. Sugar.

Custom House. New York, Oct. 28, 1904. Received.

C.	Vessel.	Ent. 1904.	Liq. 1904.	Pro. 1904.
	Hermia.	Aug. 10.	Oct. 22.	Oct. 28.

EXHIBIT J, SUIT 3825.

NEW YORK, *Oct.* 26, 1904.

To the Collector of Customs, Port of New York.

SIR: We hereby protest against your decision as to the rate and amount of duty exacted by you on 8352 packages of sugar im-

ported per s/s Monterey, on the 13 day Aug., 1904, Entry No. 165775, for the reasons following, to wit:

1. Said classification and assessment are based upon the Appraiser's return of the polariscopic test of said sugar (which is below No. 16 Dutch Standard in Color), which test and return are erroneous and excessive, owing to an erroneous and incorrect method of testing the same by the polariscope as prescribed by the regulations of the Treasury.

25 2. The law requires that the duty on sugar not above No. 16 Dutch Standard in Color shall be assessed at certain rates according to the polariscopic test thereof, by which is meant and understood to be the usual commercial polariscopic test recognized and accepted in trade between buyer and seller as ascertained by methods and instruments used by chemists engaged in the business of testing sugar, being methods in general use by sugar chemists, manufacturers and refiners at the time of the existing tariff act.

3. That the method of testing sugar by the polariscope prescribed by the Secretary of the Treasury, and which method was used by the Appraising officers in respect to the sugar in question is not the usual commercial method referred to, but differs therefrom in essential particulars, and has resulted in erroneous and excessive tests and the consequent exaction of excessive and illegal duties upon said sugar.

THE AMERICAN SUGAR REFINING CO.
OF NEW YORK,
By W. A. DENISON, *Attorney*, 117 *Wall St.*

Liquidated, Oct. 22, '04.

(Endorsed:) 26158—142331. The American Sugar Ref'g Co.—Monterey—Sugar.

Custom House, New York, Oct. 28, 1904. Received.

C.	Vessel.	Ent.	Liq.	Pro.
		1904.	1904.	1904.
	Monterey.	Aug. 15.	Oct. 22.	Oct. 28.

26 EXHIBIT K, SUIT 3825.

NEW YORK, *Oct.* 28, 1904.

To the Collector of Customs, Port of New York.

SIR: We hereby protest against your decision as to the rate and amount of duty exacted by you on 12600 packages of sugar imported per s/s Frey on the 29 day Aug., 1904, Entry No. 176310, for the reasons following, to wit:

1. Said classification and assessment are based upon the Appraiser's return of the polariscopic test of said sugar (which is below No. 16 Dutch Standard in Color), which test and return are erroneous and excessive, owing to an erroneous and incorrect method of

testing the same by the polariscope as prescribed by the regulations of the Treasury.

2. The law requires that the duty on sugar not above No. 16 Dutch Standard in Color shall be assessed at certain rates according to the polariscopic test thereof, by which is meant and understood to be the usual commercial polariscopic test recognized and accepted in trade between buyer and seller as ascertained by methods and instruments used by chemists engaged in the business of testing sugar, being methods in general use by sugar chemists, manufacturers and refiners at the time of the existing tariff act.

3. That the method of testing sugar by the polariscope prescribed by the Secretary of the Treasury, and which method was used by the Appraising officers in respect to the sugar in question is not the usual commercial method referred to, but differs therefrom in essential particulars, and has resulted in erroneous and excessive
27 tests and the consequent exaction of excessive and illegal duties upon said sugar.

THE AMERICAN SUGAR REFINING CO.
OF NEW YORK,
By W. A. DENISON, *Attorney*, 117 *Wall St.*

Liquidated Oct. 26/04.

(Endorsed:) 142333—26213—The American Sugar Ref'g Co.—Frey—Sugar.
Custom House, New York, Oct. 29, 1904—Received.

C.	Vessel.	Ent. 1904.	Liq. 1904.	Pro. 1904.
	Frey.	Sept. 2.	Oct. 26.	Oct. 29.

EXHIBIT L, SUIT 3825.

(Copy.)

Office of the Collector.

United States Customs Service, Port of New York.

NOVEMBER 23, 1904.

Board of U. S. General Appraisers, Port of New York.

GENTLEMEN: I submit the protests of the American Sugar Refining Co., Nos. 23402, 24027, 24028, 24827, 24828, 24830, 24864, 25254, 25255, 25256, 25257, 25343, 25465, 25824, 26156, 26157, 26158, 26212 and 26213, against the assessment of duty as made by this office on certain sugar imported by them in the vessels named,
the claim being made, substantially, that the polariscopic test
28 of the sugar as returned by the U. S. Appraiser is too high in consequence of the method followed by him in obtaining the test; that the Appraiser, in obtaining the test of the sugar, should

have followed the commercial usage rather than the method prescribed by the Honorable Secretary of the Treasury.

In the ascertainment of the polariscopic test of the sugar in question the Appraiser has followed the rules laid down in Department's instructions dated February 17, 1899, T. D. 20707. See paragraphs 21 to 65 inclusive.

The question at issue is similar to that which was the subject of G. A. 4386 on protest making a similar claim.

This office rejects the claim set forth in the protests and affirms its assessment of duty. Note G. A. 4386 and T. D. 25395.

Respectfully yours,

(Signed) H. E. ESTERBROOK,
Deputy Collector.

EXHIBIT M, SUIT 3825.

(Copy.)

Office of the Collector.

United States Customs Service, Port of New York.

SEPTEMBER 22, 1904.

Board of U. S. General Appraisers, Port of New York.

GENTLEMEN: I submit the protests of The American Sugar Refining Co., Nos. 20498, 20500, 20799, 20887 and 21453, against the assessment of duty as made by this office on certain sugar imported by them in the vessels named, the claim being made,
29 substantially, that the polariscopic test of the sugar as returned by the U. S. Appraiser is too high in consequence of the method followed by him in obtaining a test; that the Appraiser, in obtaining the test of the sugar, should have followed the commercial usage rather than the method prescribed by the Honorable Secretary of the Treasury.

In the ascertainment of the polariscopic test of the sugar in question the Appraiser has followed the rules laid down in Department's instructions dated February 17, 1899, T. D. 20707. See paragraphs 21 to 65 inclusive.

The question at issue is similar to that which was the subject of G. A. 4386 on protests making a similar claim.

This office rejects the claim set forth in the protests and affirms its assessment of duty. Note G. A. 4386 and T. D. 25395.

It will be noted that protest No. 20500 is withdrawn in so far as it relates to the items specified in the withdrawal attached.

Respectfully,

(S'g'd) H. E. ESTERBROOK,
Deputy Collector.

EXHIBIT N, SUIT 3825.

United States General Appraisers.

NEW YORK, *Dec.* 31, 1904.

In the Matter of Protests 30773–F, etc., of American Sugar Refining Co. against the Assessment of Duty by the Collector of Customs at the Port of New York, Before Board No. 3.

SOMERVILLE, *General Appraiser:*

The importations covered by the protests mentioned in the appended schedule consist of sugars of the particular descrip-
30 tion shown by the several reports of the local appraiser, which were classified and assessed for duty according to the polariscopic tests reported by the appraiser under paragraph 209 of the Sugar Schedule of the tariff act of July 24, 1897, which provides that sugars not above No. 16 Dutch Standard in color, "testing by the polariscope not above seventy-five degrees," shall be assessed for duty at ninety-five one-hundredths of one cent per pound, and for every additional degree shown by the polariscopic test, thirty-five one-thousandths of one cent per pound additional, and that fractions of a degree shall be assessed in proportion. All the sugars in question were tested in accordance with certain regulations for the sampling and classification of imported sugars and molasses, published as Treasury Synopsis 18508, and more recently as T. D. 20707. The contentions as made by the importers in their protests are precisely the same as those heretofore made and passed on by the Board in the case of *In re* Bartram Bros., *In re* American Sugar Refining Co., *et al.*, G. A. 4386 (T. D. 20850), where the contentions urged by the importers were briefly summarized as follows:

1. That the tests of these sugars as returned by the appraiser are erroneous and excessive, owing to an incorrect method of testing the same by the polariscope, as prescribed by the regulations of the Treasury department in question.

2. That the phrase used in said paragraph 209, "Testing by the polariscope," must be construed to mean the usual commercial polariscopic test as recognized and accepted in trade between buyers and sellers of sugar at and prior to the adoption of the tariff act of 1897.

These contentions were overruled by the Board in the case above cited, and the decision of the Board, after being reversed by
31 the Circuit Court in Bartram *vs.* U. S., 123 Fed. Rep., 327, was affirmed in all respects by the Circuit Court of Appeals for the second Circuit in U. S. *vs.* Bartram Bros., *et al.*, 131 Fed. Rep., 833. A petition for a writ of certiorari to review said decision was made to the Supreme Court, and on Dec. 5, 1904, unanimously denied.

The questions raised in these cases being identical in all respects with those passed on by the Board and the courts in the decisions

above mentioned, the protests are all overruled, and the decision of the collector in each case is affirmed.

(Signed) B. S. WAITE,
HENDERSON M. SOMERVILLE,
EUGENE G. HAY,
Board of U. S. General Appraisers.

And for a certified statement of the facts involved in said matter, as ascertained by them, the said Board states that said facts are fully set forth in the decision aforementioned, and that no other facts were ascertained by said Board than such as are shown by said decision and other Exhibits hereto attached.

EUGENE G. HAY,
J. F. FISCHER,
H. M. SOMERVILLE,
Board of U. S. General Appraisers.

32 Form No. 334.

At a Stated Term of the Circuit Court of the United States of America for the Southern District of New York, held at the United States Circuit Court Rooms in the Post Office Building in the City of New York, on the 15th day of May in the year of our Lord one thousand nine hundred and five.

Present: The Honorable E. Henry Lacombe, Circuit Judge.

SUIT "A," No. 3825.

THE AMERICAN SUGAR REFINING COMPANY OF NEW YORK
vs.
THE UNITED STATES.

On the application of the Collector of the Port of New York, through his attorney, Henry L. Burnett, U. S. Attorney for the Southern District of New York,

It is ordered that this cause be referred to Marion De Vries, Esq., or any one of the U. S. General Appraisers, as an officer of the Court, to take and return to the Court such further evidence herein as may be offered by the said Collector, and that the importers or their attorneys have reasonable notice of the time and place of taking such further evidence.

E. H. LACOMBE,
U. S. Circuit Judge.

(Endorsed:) Suit "A" No. 3825—U. S. Circuit Court, Southern District of New York.—The American Sugar Refining Company of New York, against The United States.—Application and order to take further evidence.—Henry L. Burnett, U. S. Att'y and Att'y for Collector.—U. S. Circuit Court, Southern District New York, Filed May 15, 1906, John A. Shields, Clerk.

33 United States Circuit Court, Southern District of New York.

No. 3825.

THE AMERICAN SUGAR REFINING COMPANY OF NEW YORK
v.
THE UNITED STATES OF AMERICA.

To the Circuit Court of the United States for the Southern District of New York:

The undersigned, a General Appraiser under the Act of June 10th, 1890, to whom it was referred by this Honorable Court by an order made May 15, 1905, to take further evidence in the above-entitled matter, do hereby return such further evidence taken by me pursuant to such order.

Dated, New York, Oct., 1905.

W. B. HOWELL,
United States General Appraiser,
as an Officer of the Court.

34 United States Circuit Court, Southern District of New York.

No. 3825.

THE AMERICAN SUGAR REFINING COMPANY OF NEW YORK
vs.
THE UNITED STATES OF AMERICA.

NEW YORK, *October* 19, 1905.

Before Hon. William B. Howell, as Officer of the Court.

Appearances.

For the Petitioners: Messrs. Parsons, Closson & McIlvaine (by Albert S. Wright, Esq.).

For the United States: Charles Duane Baker, Esq., Ass't U. S. Attorney.

Stipulation.

In this cause it is agreed that the sugars in question were tested and classified in accordance with the treasury regulations of October 27, 1897, and of February 17th, 1899, and that the questions raised are the same as those in the cases of Joseph E. Bartram and others *v.* The United States, Benjamin H. Howell and others *v.* The United States, and The American Sugar Refining Company *v.* The United States reported in 123 Fed. Rep. 327 and in 131 Fed. Rep. 833 and it is agreed that the evidence and exhibits in those cases contained on pages 33 to 364 inclusive and pages 373 to 734 inclusive of the Transcript of Record in those cases prepared for the

Supreme Court of the United States and contained in the volume filed herewith and identified by the signatures of Parsons,
35 Closson & McIlvaine, attorneys for the petitioners, and of Henry L. Burnett, U. S. Attorney for the United States, are to be treated as duly taken and introduced as evidence in this cause.

Mr. WRIGHT: I offer in evidence the deposition of Alexander Herzfeld taken in this proceeding before Albert S. Wright, Notary Public, April 28, 1905, which original deposition is already on file with the Clerk of this Court.

Mr. BAKER: I object to the deposition offered by the learned counsel upon the ground, first, that it appears from the face of the deposition itself that the testimony of the witness, therein set forth, was not taken before a Referee duly appointed by the Circuit Court in the suit in question; second, upon the ground that the testimony of the witness contained in said deposition, is irrelevant, incompetent and immaterial; and, third, upon the ground that the testimony of the witness named in the deposition offered in evidence was not taken in accordance with or pursuant to the provisions of the Act of 1890, known as the Customs Administrative Act.

The REFEREE: The objection is sustained, on the ground that there is no provision in the statute for the taking of depositions in those cases *de bene esse*.

Admission of deposition insisted upon under Rule XI; so admitted.

Testimony closed.

36 *Testimony.*

[Taken in Pursuant to Foregoing Stipulation.]

Before the Board of U. S. General Appraisers.

In the Matter of the Protest of THE AMERICAN SUGAR REFINING Co., *34769-F*, *32662/3-F*, *31941-F*, and *35348-F*; BARTRAM BROS., *31180-F*, and B. H. HOWELL, SON & COMPANY, *31501/4-F*. 2918, 2919, 2920.

NEW YORK, *Dec.* 15, 1898.

Present: General Appraiser Somerville, chairman; General Appraiser Tichenor, General Appraiser Wilkinson.

Appearances.

W. J. Gibson, Esq., for the Government.
A. K. Tingle, Esq., for the American Sugar Refining Co.
W. D. Goodwin, stenographer.

FERDINAND GERHARD WIECHMANN, called as a witness for the protestants having been duly sworn, testified as follows:

By Mr. TINGLE:

Q. Will you give your full name, Doctor?
A. Fer-inand Gerhard Wiechmann.

Q. What is your profession?

A. I am a chemist by profession.

Q. Of how long experience?

A. I graduated in the year 1881 from the school of mines, Columbia College. I then pursued a post-graduate course at Columbia university, taking my degree as doctor of philosophy in June, 1882. During the year just referred to, I also acted as private assistant to Professor Charles F. Chandler, professor of chemistry of the university. In the fall of 1882 I went abroad and was inscribed as a regular student in the university of Berlin. I returned to the
37 States in 1883 and was appointed a fellow in chemistry at Columbia university, and have served in various grades as teacher of chemistry at the university until July, 1897, when I resigned. Since the fall of 1883, I may say, I have been connected with the sugar industry in New York and vicinity. My first experience was with the Brooklyn Sugar Refining Company for two years, and then for six months with the Havemeyer Refining Company at Green Point. In the fall of that year I accepted one with Havemeyer & Elder's with which concern I am now.

Q. You have given special study to the question of sugar chemistry?

A. I have done so since the fall of 1883.

Q. Are you acquainted with the manipulation of the polariscope?

A. I consider myself fully acquainted with the workings of the polariscope.

Q. How long an experience have you had in the use of the polariscope?

A. Well, I have handled it off and on all the time from the fall of 1883 to the present time.

Q. Are you familiar with what is known as the commercial test of sugar?

Mr. GIBSON: One moment. I ask to have that stricken out because no such thing as the commercial test of sugar has been established.

Mr. TINGLE: I will put it this way: Is there a method of testing sugar, universally known and adopted in the sugar trade, and known and considered as the commercial test, by which sugars are bought and sold in the United States and in Europe?

A. There is.

Mr. GIBSON: I object to that.

(Mr. TINGLE:)

Q. Is there a test of sugar used in commerce, in buying and selling sugar—by which it is bought and sold?

A. There is.

Q. How extensive is that test used in the trade?

A. The test to which I refer, to the best of my knowledge and belief, is used by all buyers and sellers in the United States, and with perhaps only a difference of weight in sample, is employed, to the

best of my knowledge and belief, in all countries in which the buying and selling of sugars goes on constantly.

Mr. GIBSON: I object to that.

Q. Have you ever engaged in the business of buying and selling sugar?

A. I have not.

38 Q. You have been connected with some firms as a chemist?

A. Permit me,—with three concerns.

Q. With the American Sugar Refining Co., the Havemeyer and Havemeyer and Elder?

A. Exactly.

Q. As far as your experience has gone in dealing in sugar it has been confined to those three concerns. Did you have any other experience in testing sugar except these three?

A. As their adviser. The matter is one — which I have given a great deal of time and attention, and in the course of my connection with these three concerns an opportunity has been given to check my work with a great many chemists of Europe. They employ this particular method to which I have just referred: this is the full extent of my knowledge.

Q. How many concerns did you come in contact with in testing sugar in this country?

A. I have stated three, sir.

Q. Did you ever compare your tests you have given with other chemists?

A. With the work of certain chemists of other concerns upon which I had to pass and deliver an opinion, yes.

Q. How many?

A. That is impossible for me to tell, because the tests are simply sent to me.

Q. You compared how many tests in that way?

A. That is impossible to say. I could not well do so.

Q. These three concerns are all located in Brooklyn?

A. To the best of my knowledge and belief, yes, and Greenpoint.

Q. Have you had anything to do with testing sugars for any concerns in Philadelphia or Baltimore or in San Francisco?

A. I have examined sugars——

Q. I mean for any other concerns.

A. I have tested some sugars of the so-called Spreckles refinery——

Q. Any other concern there?

A. Those were exceptional cases.

Q. Any other place?

A. I have done so in—no, I think I will answer no to that.

Mr. GIBSON: I submit that on this point the board will observe here that at the very start of this hearing it is attempted to bring in a distinction by saying that there is a commercial test. There is no such test, and we do not propose that the board shall be misled. I think this witness is not competent to testify on any definite, uniform, general custom prevailing in the sugar trade.

Judge SOMERVILLE: I think he is competent and admit his testimony, to show, as far as his knowledge extends, what custom may have prevailed in the trade, within his experience.

39 By Mr. TINGLE:

Q. Please state what constitutes the commercial test of sugar, as you understand it, the method, used in reaching the test of sugar as used in commerce and trade?

Mr. GIBSON: I object to the use of the word "commercial" to designate a test by that designation.

Objection overruled.

A. The commercial method of testing sugar which I believe is in general use, is as follows.

Q. Don't you know that it is?

A. I know of no exception to it. In commercial practice, 26.048 grammes of sugar to be tested are weighed out in air, by means of brass weights, and the amount so obtained is dissolved up to 100 Mohr cubic centimetres. This is introduced into a flask which has a value of 100 Mohr cubic centimetres at the temperature of 17.5 degrees centigrade; some water is introduced into this flask and the sugar is brought into solution, and a minimum amount of clarifying agent or agents necessary to give a clear solution, and a solution of light color, are added. Then the contents of the flask are made up to the mark on the flask which indicates 100 cubic centimetres by the Mohr standard. The solution thus obtained is then filtered, care being taken to avoid any concentration of the solution by evaporation during the process of filtration. And the filtrate thus obtained is placed in a tube exactly 200 millimeters in length, the ends of the tube being closed with glass covers, the caps are screwed on lightly and in a manner that exerts no stress or strain upon the glass. The tube is then placed into the trough of the polariscope and the observer's eye is applied to the instrument. When a solution of sugar is thus introduced into the field of a polariscope standing at zero, it will be observed that a change of color or change in the intensity of the illumination is apparent in the two halves of the field. The observer then, by means of a screw, introduces a certain quartz wedge, which is an important part of the instrument, and by this means, by the adjustment thereof, he is enabled to compensate for the inequality of the color produced by the sugar solution, and is able to restore equality of tint in the illumination of the full field of the polariscope. He then places his eye to the glass provided for the purpose, and on a scale he reads off a certain number, which, if the test has been properly performed, and, in the manner indicated, represents the so called polariscopic test of the sugar; this being the basis upon which the value of the sugar is calculated. In other words, the instrument, if so handled, will indicate at once the quantity of sucrose in the solution. I believe this is as clear as I can make it.

Q. This method of testing sugar is the method used by the trade

generally, or universally, in the United States, and in Europe, is it?

A. As far as I know it is.

Q. Has the system been prescribed by any scientific body, or approved by any such body?

A. This method that I have just described has been in use, common use, for many years; in fact, it is the method upon which the graduation of the instrument is based. The method just described is the method adopted for the use of the polariscope many years ago. It is used in many laboratories in Germany, and in the United States it may be acknowledged as being the only method, and it is referred to in all standard works on sugar chemistry. It is, in fact, I may say, the only recognized method of determining the polarization of sugars by the polariscope.

By Judge SOMERVILLE:

Q. Can you mention any authorities who have recognized this method you have just described?

A. Foremost, and first of all Professor Wiley, in his valuable work on agricultural analysis, Freuhling & Schultz, Prof. Landolt's work an optiches dresungs-vermogen Organischer Substanzen; Doctor Tucker's work on sugar analysis, and in fact I know of no standard work on sugar but what refers to this method. Dr. Sidersky's work, also.

By Mr. TINGLE:

Q. Have you examined the method of testing sugar by the polariscope prescribed by the Treasury Department, in its regulations of October 27, 1897?

A. I have.

Q. Can you state how that method differs from the method you have just described?

A. I can.

Q. Please so state?

A. In the method which is prescribed by Treasury regulations, just referred to, 26.048 grammes absolute are taken——

Q. Is that the same as in your method?

A. But in this case the so-called absolute grammes are used, as care is taken to introduce certain changes in the volume in which the sample is dissolved, so as to make the weight absolute weight, that is, to render its weight to a vacuum.

The United States Treasury regulations call for this weight: 26.048, absolute weight, to be weighed in vacuo, although the actual weight has occurred in air. The weight so obtained is introduced into a flask which is said to be graduated in true cubic centimetres instead of in the Mohr cubic centimetres. The Mohr cubic centimetre referred to is an arbitrary standard. After the introduction of the solution into the tube its reading is obtained, the necessary amount of clarifying reagents have been introduced. The solution is filtered, the filtrate is introduced into a polariscopic tube 200 millimeters in length, and its reading is taken. The regulations call for

the use of two clarifying agents; subacetate of lead and
41 alumina cream, the latter to be used in twice the volume of the subacetate of lead solution used. The solution is then filled up to the mark which is engraved on the flask; it is then filtered; the filtrate is introduced into the polarization tube, and the polarization is taken in the instrument as I have previously described. But that is not all that is required in the operation prescribed by the Treasury Department method. A quartz plate is next introduced into the polariscope and its reading obtained. The observation of a thermometre, which hangs inside of the polariscope booth is taken to indicate the temperature at which the observation is made. The quartz plate having been introduced into the trough, a second observation is made, which gives the observer the reading value of this quartz plate; this reading having been obtained, a table of so-called sugar values is consulted. This is a table which is authorzed by the Government for the use of their men for the purpose of these tests, and the observer is required to look up in the table the sugar value which corresponds to the temperature indicated at the time by the thermometer, hanging in the booth. Then the comparison is made between the reading value of the quartz plate and the sugar value itself, as at that time indicated, and if they are not identical then a process of calculation is gone through with and a correction introduced accordingly as the reading value of the solution or the sugar is higher or lower, as the case may be. The value so obtained is added generally, or subtracted from the reading value obtained from the sugar solution, and the result is called the corrected polarization.

Q. How do the sugar values thus obtained by this method vary from the values obtained by the commercial method that you have described before?

A. It has been my experience that the tests obtained by the U. S. Treasury method, just described, invariably are higher than the tests obtained by the commercial method.

Q. What measures have you taken to verify that fact?

A. I have made a number of examinations of different samples of sugar by both the U. S. Treasury method and the commercial method. I have particularly directed my attention in testing these different sugars in getting sugars which should be as closely chemically pure as I have been able to obtain, but which by my——

Q. Refined sugars?

A. —by my treatment, as I have said, I obtained for this purpose a sugar which tested 99.98 %——

By Judge SOMERVILLE:

Q. How many tests of that kind did you make?

A. Probably a dozen or more, sir; also I have examined raw sugars. I have chosen for my experiments this chemically pure sugar, for the purpose of showing and bringing out clearly the difference between the two methods. A chemically pure sugar,
42 if correctly examined, should test 100. That is admitted and universally established. In following these regulations of the

U. S. Government method, I have invariably obtained results of over 100 %, ranging from 100.20 to 100.05% ; and this in the chemically pure sugar when examined with the utmost care and skill, on a correct polariscope and under the observance of all the conditions prescribed.

By Mr. TINGLE:

Q. Have you ever known any instance in trade where sugars have been bought and sold upon such a test; that is, the test made by the methods adopted by the Treasury Department?

A. No, sir; I have not.

Objected to as immaterial; objection overruled.

Q. Do you know that the Treasury method of testing sugar is not used in trade and commerce by sugar merchants and sugar chemists?

Mr. GIBSON: One moment, that is entirely irrelevant.

(WITNESS:) Will you repeat the question?

Q. Do you know that the Treasury method, as prescribed by the Treasury, is not used in the trade?

A. It is my understanding that it is not.

Q. The corporation with which you are connected deals in sugars from all parts of the world, does it not?

A. It does.

Q. It receives sugar from all parts of the world?

A. It does.

Q. You are called upon to test sugars from all parts of the world?

A. I am.

Q. In the course of your experience in testing sugars, have you ever heard of any sugar being bought and sold upon a test obtained by the methods adopted by the Treasury Department?

A. I have not.

Q. Do you know of any scientific body or authority in the entire commercial world, or in the scientific world, that has given approval to this method of testing sugar?

A. I do not.

Objected to as immaterial and irrelevant.

(WITNESS:) I have never heard of any scientific authority or society whatsoever approving of it, but I have secured the opinion of one of the most eminent authorities upon the subject of this method.

By Mr. GIBSON:

Q. I understood you to say in your direct examination that the method that you adopted and have referred to as the com-
43 mercial method, or mercantile method, was universally used throughout the world, in its dealings in sugar?

A. I said it was so, to the best of my knowledge and belief.

Q. Do you know whether or not it is used throughout Europe?

A. Yes, sir; to the best of my knowledge and belief.

Q. Do you know whether or not this method that you say is the commercial method, is used in France?

A. The method to which I have referred as being the commercial method, is used in France, with the exception that they have another normal weight for the polariscope; instead of 26.048 grammes, and they have a different volume of solution.

Q. The method that you have characterized as being used throughout Europe is not used in that identical form or manner that you have described was universal?

A. With the exception of normal weight being different to correspond with the different graduation, otherwise the methods are exactly identical.

Q. Do they use the same flask in France?

A. That question must be answered by saying that they always use a flask dependent upon the weight that they make up. If they use a given normal weight then they use a flask to correspond. Austrian chemists use the normal temperature of 17.5 and the Mohr cubic centimetre.

Q. Do they use the Mohr flask, the flask that you have been using?

A. They use it in Germany where our instruments are graduated——

Q. Don't they use the metric flask, isn't that known and used in all the commercial dealings in France?

A. Not to my knowledge.

Q. Do you know to the contrary?

A. I don't.

Q. In regard to Belgium, do you know whether or not in testing sugars by the method you have described as being universal through all Europe, is that flask used in Belgium?

A. I don't know.

Q. Can't you answer that, yes or no, if you have had dealings with Belgium?

A. Not direct.

Q. Have you tested sugars from Belgium?

A. I have.

Q. Tested sugars from Belgium? Seen their test?

A. I have.

Q. Can you tell from that whether the same method was used?

A. I can say that in using a different flask, if they use a different flask, they use a different normal weight that corresponds. They don't use one kind of normal weight without a flask to correspond.

Q. How do you know that?

44 A. What. By reading the descriptions of the methods they employ.

Q. I understand you have no personal knowledge, only what you have read about it. Give the works or papers that you have read about it?

A. Well, for instance, Prof. Sidersky of France and Prof. Francis Sach of Brussels, have works on the subject.

Q. Do these books that you have specified give this method as the method that is used?

A. It is given as the method used in Belgium, and in France.

Q. Does it state so in these books?

A. Yes.

Q. Is this the commercial method in these cases or the Government method alone? I understood you to include the United States, within that catagory which your method was used?

A. It is not my method.

Q. The method you have described?

A. That is the method in trade.

Q. Are you familiar with the histories in the United States of the use of the polariscope?

A. In a general way, yes.

Q. Is this the first time that the polariscope, such as the method in use in testing sugar under the act of 1897, has been used in this country?

A. It is practically the same method as prescribed under the bounty law of 1890.

Q. Under the sugar bounty——?

A. It is prescribed, whether it is used I cannot say.

Q. In your reading up have you not taken care to inform yourself on that subject?

A. On these regulations?

Q. Are those regulations that are now in force under the act of 1897, so far as you know, substantially the same as they were under the act of 1890?

A. They are similar.

Q. Do you know whether or not there was any duty on imported sugars at that time, 1890, that required the use of the polariscope?

A. The duty on imported sugars collected by the Government was by the commercial method.

Q. Was there any duty on sugar under the acts of 1890-94? Was there any duty imposed upon sugar under the act of Oct. 1, 1890, from that time up to 1894?

A. I don't know; that is beyond my province.

Q. Do you know what method was used then by the Government in testing sugar under the act of 1890?

A. To the best of my knowledge and belief they used the method which we distinguished from the Treasury method by calling it the commercial method.

Q. And you have just described as the commercial method;
45 that method was in use by the Treasury Department, as you understand it up to the date of these regulations (1897)?

A. Yes, sir.

Mr. GIBSON: One moment, now——

Q. You were asked whether the tests by the buyers' chemists and the sellers' chemists ever agreed; are the chemists known as trade chemists, considered buyers' chemists, or are they public chemists——

Mr. GIBSON: One moment, I object to that——

Q. What are they known as?
A. As trade chemists.

Objected to.

Q. You have spoken of Dr. Wiley's book on sugar chemistry, I believe it is; does that contain any statement in regard to the influence of temperature on the results of testing sugar?
A. It does.
Q. What is that statement?
A. The statement of Professor Wiley, made in his work, is this: That the influence of temperature is absolutely unappreciable, provided the solutions are made up at the same temperature at which they are polarized, and furthermore, that the influence upon the gyrodynat that is the specific rotatory power of the sugar, is of very slight importance, if of any. I have the work here.

(Book entitled "Principles and Practice of Agricultural Analysis, vol. 3, by Harvey W. Wiley, chemist of the U. S. Department of Agriculture," handed to witness.)

Judge SOMERVILLE: Kindly cite the page to which you are about to refer.

WITNESS: Page 117, paragraph 103; the reference I have referred to is short, may I be permitted to read it?

"103. Variations in specific rotatory power.—The gyrodynat of any optically active body varies with the nature of the solvent, the strength of the solution, and the temperature.

"Since water is the only solvent of importance in determining the gyrodynat of sugars, it will not be necessary here to discuss the influence of the solvent. In respect to the strength of the solution, it has been established that in the case of cane sugar the gyrodynat decreases while with dextrose it increases with the degree of concentration. The influence of temperature on the gyrodynat of common sugars is not of great importance save in the case of levulose, where it is the most important factor, the gyrodynat rapidly increasing as the temperature falls. It is of course understood that the above remarks do not apply to the increase in the volume of a solution at changed temperatures. This influence of temperature is universally proportional to the change of volume in all cases, and
46 this volumetric change is completely eliminated when the polarizations are made at the temperatures at which the solutions are completed to standard volumes."

(Mr. TINGLE:)

Q. You stated in your first examination that upon comparing the results of your tests by the commercial method and by the Treasury method you found that the tests were higher by the Treasury method by some two or three-tenths, or four-tenths, something of that sort. To what do you attribute that difference?
A. I attribute that difference to the fact that the correction for temperatures was observed, when none is called for or justified, as

under the conditions of polarization there is no decrease in the rotatory power of the sucrose or change of temperature in the sucrose.

Q. Is that due to errors in the methods pursued?

A. It is due to errors in the Government regulations.

Q. Did you find any other errors in the Government method or regulations, as taken from a scientific point of view?

A. There are several to which I decidedly object. In the first place we declare to be erroneous their method of preparing the sugar solutions for examination——

Q. Meaning, of course, for polarization?

A. They call for the use of an absolute weight, instead of weight in air, they call for the so-called true cubic centimetre flask and require that all weighings shall be referred to a vacuum, and substitute the so-called true cubic centimetre flask for the Mohr flask which was intended to be used by the makers of the instruments. I firmly maintain that the arbitrary substitution of one set of working conditions for an instrument, the use and graduation of which are based upon a different set of working conditions, necessarily lead to errors and the instrument cannot give the truth. Then the vital objection is the one I have explained; that a correction for temperature is made where the circumstances do not call for or warrant any such correction——

Q. Pardon me—for the reason that——

A. That no decrease in the rotatory power of the sugar solution occurs when the sucrose solution is polarized at the same temperature at which it is made up, and the Government method insists upon this very thing being done.

Q. That is, the Government regulations require the solution to be made up at the same temperature and then require further this correction to be made in addition?

A. Yes, sir.

Objected to.

Q. When you say the Government regulations require that "very thing" meaning, of course, it requires that the solutions shall be polarized at the same temperature at which they are made up?

A. Yes, sir. Before answering that question further, if
47 your honor will permit me, I have made a little memorandum of one or two objections, and to which, permit me to refer: First and foremost of my objections to the Government method of testing sugars, is the fact that they call for and employ a correction, or so-called correction, for the decrease in the rotatory power which the sucrose solution is assumed to have experienced in polarization. It is perfectly true that if a sucrose solution be made up at a temperature of 17.5 centigrade, and polarizes, say 100% at that temperature that, if that same solution be polarized at a temperature of 27.5 degrees centigrade, it no longer polarizes 100, but 99.7, or very closely thereabouts. But it is also true that a sugar solution made up at any degree of temperature, say 17.5, 20, 25 or 30 degrees centigrade, and polarized at the temperature at which it was made up, will invariably show the same polarization. That is, if I take

one sugar and make up a solution at 17.5, and it tests 100, and if I take that same sugar and prepare and polarize the solution at the temperature of 25 degrees centigrade, it will also test 100. It is with this latter condition, not with the first, that we have to deal in practical sugar chemistry. The regulations themselves call for the polarizing of the solution at the same temperature at which it was made up. They are so particular on this point that the Government requires the operator to be careful not to handle the bulb of the flask with the hands during the operation for fear of changing the temperature of the solution in the meantime. The vital objection, I repeat, to the U. S. regulations, as introduced, is the correction factor, to allow for a decrease in the rotatory power of the solution which has never occurred. Following the Government method strictly and conscientiously in every detail, I have, in polarizing sugar that had a value of 99.98 by the universally accepted commercial method, never found it to polarize less than 100.20. To be exact in that instance, never less than 100.275. The average of about ten or twelve tests have been 100.3125, meaning, by the Government method we succeeded in getting a chemical polarization of three-tenths over one hundred per cent. The Government method thus assigns to a sugar a value of fully 0.3 over and above 100 per cent.

The other objections which I have to make are these: The regulations require the use of a normal weight which is wrong and the use of a wrong flask. In other words, the employment of a normal weight and flask different from those for which the instrument was graduated and which its makers intended should be used to insure correct results from the instrument. We furthermore object to the specification which calls for the use of alumina cream in double the volume of subacetate of lead employed for clarification (page 24, line 31). "The use of subacetate of lead should, in all cases, be followed by the addition of 'alumina cream' in about double the volume of the subacetate solution used, for the purpose of completing the clarification, precipitating excess of lead, and facilitating filtration.

48 In making up raw sugars it is known that this reagent added to the solution combines with certain impurities in the sugar solution for polariscopic observation and entail unavoidable concentration of these solutions, thereby rendering the polariscope reading too high. We have to make up a given weight of sugar to a given volume, it is understood; such a precipitate having been thus found occupies part of the space that ought to be occupied by the water with which the sugar solution is made up. Too concentrated solutions of course mean too high polarizations. You are given a flask, and you put into that flask your sample of sugar. You are supposed to dissolve that in water to bring it up to the mark indicated on the flask. We must, unfortunately, in making up such raw solutions, add certain chemicals, which combine with impurities in the raw sugars. It will be seen at once that the addition of subacetate of lead and alumina cream to the solution cause space to be occupied which it was intended should be occupied by the water, for of course two bodies cannot occupy the

same position at the same time, and water expands at a temperature above 4 degrees C. It is important to use as little clarifying reagent as possible. Therefore we object to the use of subacetate and alumina cream, the latter in double the quantity of the former, as required by the regulations. In my experience I have rarely found it necessary to use alumina cream. I have it on my shelf, but rarely use it.

Another objection that I make is—entirely aside from the fact that the so-called corrections are entirely uncalled for and erroneous—rests upon the fact that the quartz plate, the mounted quartz plate, is made to be the basis of these corrections. Now, quartz is a mineral substance that polarizes light. The quartz plate is introduced in connection with the so-called correction for the supposed decreased rotatory power of the sucrose solution during polarization. We are not confronted with conditions which bring about a decrease in the rotary value of the sucrose solution. I desire to point out that the very means and methods adopted by the regulations for effecting the intended corrections are open to serious criticism. A sudden change of temperature to which a mounted quartz plate is subjected, may materially permanently change its optical value. I have myself had experience with a quartz plate which had tested about 86 degrees Ventzke when loosely held by two springs. I then subjected it to a certain pressure by means of screws, the temperature remaining constant throughout; and then this plate showed an increase in rotatory power which was carried up from 86 degrees to over 100 degrees fully 14%. At this point the pressure was discontinued and the plate quickly resumed its original optical value. I may add here that Prof. Herzfeld of Berlin experimented with me in this connection. Now, furthermore, it has been my experience that a quartz plate, which I had for ten years and which had always shown a value of 99.9 to 100.0 when tested against chemically pure sugar solutions, suddenly, after a short immersion in water
49 at a temperature of 35 C., had its rotatory value increased by three-tenths. This change of value occurred about five months ago, and to the present day this plate retains this value of 100.3 in all temperatures between 17.5 and 33 degrees C. I only want to call attention to the danger of using such methods, which prescribe the use of finely-mounted quartz plates, and to the fact that when a change of this so-called standard takes place, the readings are necessarily wrong.

These are the main points of my objections. There are others, but my statements cover the points briefly without fully exhausting your patience.

By Mr. GIBSON:

Q. In following the Government method in making your experiments, what plate did you use in polarizing?

A. I have used one standardized by the Government itself.

Q. What others?

A. One, the value of which I myself determined.

Q. Which one did you use in getting the results?

A. Principally my own. That one having been in use for ten years.

Q. Without having been standardized?

A. It has been standardized by myself.

Q. What flask did you use?

A. I have employed both the true cubic centimeter graduated by the Government and one graduated by myself.

Q. Which one did you use?

A. Chiefly the one standardized by myself.

Q. I understood you to say that you followed strictly the Government method?

A. I have done so.

Q. Doesn't that method require that all flasks shall be standardized by the division of weights and measures of the Coast and Geodetic Survey?

A. As I understand, it requires all the flasks used by the Government officials shall be.

—. Do you or do you not know that for a period of about four years the Government used this method that you have spoken of in testing sugars on which it paid bounty?

A. I don't know, I believe it did.

Q. Now, Doctor, in your testing by the method that you have spoken of, you took into the consideration the temperature?

A. I took into consideration temperature to just this extent: I always seek to make my polarizations at the same temperature that I make my solution.

Q. Do sugars polarize the same at all temperatures?

A. If a sugar is made up at any given temperature, whether you make it up at 17.5 or 20 or 30 C. and polarization made at the same temperature the result will be the same.

50 Q. Now all the instruments that you use are graduated to polarize at a temperature of 17.5?

A. I said the instrument which is in common use in the United States, both by the Government officials and others, has been graduated at the temperature of 17.5 C.

Q. Now, then, I understood you to say that you didn't make any allowance for the difference in temperature above or below 17.5?

A. I maintain this: I do not; none is called for.

(Question read.)

A. I make no allowance for correction for temperature because none is called for in the method by which I conduct my test.

Q. You follow the instructions recommended by the makers of these instruments?

A. I make my tests in the manner followed by every user of the instruments, I do, yes.

Q. For the purpose of insuring exact graduation don't the makers of these instruments require it to be at a temperature of 17.5?

A. They don't.

Q. I understood you to testify on your direct-examination that

fluid water—that it expands beyond a temperature of four degrees centigrade?

A. Yes, you are correct.

Q. There would be some difference in a given volume of water, would there not, at any temperature above 4?

A. There would.

Q. Now, would not a solution, then, composed of water and some other substance, say sugar for instance—would it not vary to the same extent then by any degree of temperature above four?

A. It would, but to such an extent it is not measurable within the limits that we have to deal.

Q. Do you ordinarily test all these sugars that you have testified about in a temperature of 17.5?

A. I do not.

Q. Usually made at a higher temperature are they not?

A. Nearly always.

Q. A temperature probably of eight or ten degrees higher than that?

A. Sometimes even more than that.

Q. The average would be how much?

A. It depends upon our room.

Q. Probably 15 degrees higher?

A. No; varies in temperature; in August it may reach 104, in winter it is very much less.

Q. Now, every sugar refiner, or every large dealer has his chemist who looks after the sugar matters, does he not?

A. I believe they have.

Q. The buyers of the sugar have a chemist and the sellers have?

A. They employ such men.

51 Q. Do you compare your tests made of the sugar for your concern with the tests made by the chemist of the buyer, do you not?

A. I do not.

Q. Do you ever compare it?

A. Not as a part of my regular work that does not come to me.

Q. Do you ever compare your tests of the same sugar samples with the tests made by any other chemists?

A. I do.

Q. It is invariable that your tests and his tests are identically the same?

A. They are not.

Q. Are they ever identically the same?

A. Yes, they are.

Q. In what proportion?

A. I cannot answer.

Q. Are they once in ten cases—in ten times?

A. I decline to answer.

Q. Are they the same once in 20 times?

A. I do not know.

Q. Once in 100 times?

A. I think my first answer covered all those points.

Q. You are not the chemist of either the buyer or the seller?

A. I am chemist for the American Sugar Refining Company, stationed at Havemeyer & Elder's.

Q. Now, do you know Prof. Wiley, who is here present, and do you know Doctor Crampton?

A. I have been introduced to the gentlemen.

Q. And Mr. Braid?

A. I have met the gentleman.

Q. Have you conversed with them on the subject of these sugar tests?

A. I have .

Q. How recently?

A. Last spring, I do not exactly remember the date, I think it was April or May; we had one conference in this building and one in my laboratory in Brooklyn.

Q. On the subject of sugar testing?

A. It was that, yes.

Q. As to the method formulated by the Government?

A. I have.

Q. And the method pursued by yourself?

A. Came into the discussion naturally.

Q. You discussed their relative merits?

A. I did not understand the system of sugar values of the Government.

Q. Do you understand them now?

A. I certainly think I do.

Q. Where did you get your information, Doctor, since?

A. By exhaustive reading of the regulations and by experiments carried out in accordance therewith.

52 Q. Were you present last year in Vienna at a conference of chemists?

A. I was.

Q. You were present there during a discussion of a paper read by Prof. Wiley?

A. May I require that the specific instance be recalled? There were several papers on sugar discussed.

Q. Were you present when Doctor Wiley read his paper before the International Congress on Practical Chemistry at Vienna?

A. I had the honor to preside at that session when Professor Wiley read his paper.

Q. That paper was on the influence of temperature on polarization in sugars?

A. It was.

Q. Do you know whether the buyers and sellers who test sugars are uniform, are they uniform?

A. I cannot say.

Q. You referred to Doctor Wiley's book in connection with this subject, didn't that book approve of the method of testing sugar?

A. Not to my knowledge.

Q. Does it give the Government method of testing sugars?

A. That I cannot say. May I add something? His book is very

thorough and I presume it does mention it, but not to my knowledge.

Q. I understood you to say that no scientific body has ever approved the Government method of testing sugar?

A. Not to my knowledge.

Q. Did you ever hear of such a body as the Coast and Geodetic Survey of the United States?

A. I have.

Q. Do you know whether or not they have ever approved these methods?

A. I do not know.

Q. Is that body the highest scientific body established by law for the adjustment of weights and measures?

A. I am afraid I am not competent to frame an answer to that question on that subject—too modest.

Q. Does the temperature have any influence on the polarization of a quartz plate?

A. It does.

Q. What difference does it have—what influence does it have?

A. That depends upon the manner in which the quartz plate is presented for examination. A quartz plate is subject to a change if exposed to an increased temperature, strain or pressure. There is no telling how great the difference may be to which it is affected.

Q. I understood you to say on your direct-examination that there was no difference—that of temperature.

A. I said it made no difference with the sugar. I would not so state in regard to the quartz plate.

53 Q. Didn't you state on your direct or redirect-examination that the polarization of a quartz plate, that the temperature didn't make any difference?

A. I did not wish to have you understand me that way.

Q. How is the rotation produced by a sugar solution measured by polariscopes in common use?

A. I can give you theories.

Q. Isn't it measured by the quartz wedge?

A. The amount of rotation is measured by quartz wedges, yes.

Q. If that be so, will not the value of the sugar solution be different at varying temperatures?

A. If the quartz wedge be affected? No, it will not be to such a degree that one could measure it on the commercial polariscope.

Q. Now, didn't I understand you to say substantially, on your redirect-examination that the principal matter of difference *are* between the test that you call the commercial test and the Government was that allowance which the Government makes for temperature?

A. I understand that is a point of contention.

Q. And that the substantial matter of difference is the allowance the Government makes for temperature?

A. There are several contributory causes, such as the use of *two* much clarifying agent; allowance for temperature and the addition of the clarifying agents are main causes in my opinion.

Q. The matter of temperature leads them all, you think?
A. If this allowance for temperature were eliminated, you mean?
Q. Would you make any contest on the other minor points? Those are the real ones, are they not?
A. No, they are certainly not.
Q. Do those other objections of yours, do they make any particular difference?
A. They certainly do; every one of them contributes to the polarization of the sugar higher than the true polarization.
Q. Assuming that the Government did not make this allowance for temperature, would there be—that being out of the way—would there be any appreciable differences between the test of the Government and that which you have described as the commercial methods?
A. I should still object.
Q. Would there be any difference, materially?
A. There might be on account of the danger introduced by the use of the quartz plate.
Q. It would be problematical?
A. No, it would be a settled probability.
Q. Would it be a sure thing?
A. I don't know; I cannot see the future.
Q. Do you know whether or not the commercial tests are sometimes higher than the tests made by the Government?
54 A. I have no knowledge of such being the fact.
Q. Have you ever heard of it?
A. This morning, when you, to my great surprise, stated that you had taken up a case where the tests that the Government results were lower.

By Mr. TINGLE:

Q. Is it quite reasonable that there might be great variations in the tests due to the difference in the samples used?
A. Certainly.

JOHN A. SHERER, called as a witness for the protestants, having been duly sworn, testified as follows:

By Mr. TINGLE:

Q. Mr. Sherer, what is your business?
A. Sugar chemist.
Q. How long an experience have you had in that business?
A. Over 20 years, polarizing.
Q. In that time have you become familiar with trade usages and customs in buying and selling sugar and in the testing of sugar?
A. Yes, sir.
Q. How did you acquire that knowledge?
A. By testing sugar for the trade.
Q. Any other awy—intercourse with the trade and familiarity with prices?
A. I have had a great deal to do with valuations of sugars, under the *ad valorem* duty, for importers and also——

Q. You have heard the testimony of Doctor Weichmann?
A. Yes, sir.
Q. Does your experience coincide with his in regard to the so-called commercial test?
A. It does.
Q. Do you understand what is meant by the words "polariscopic tests" as used in the law?

Not competent, ruled out.

Q. Will you please state, during your experience in the last 20 years, what has been the method of testing sugar in the trade, and by the Government, up to the date these regulations of 1897 took effect?
A. By the trade was that described by Doctor Weichmann, his testimony exactly.
Q. What was the method by the Government?
A. The Government method was practically the same, up to the time of the introduction of these regulations now in force.
Q. Was sugar tested when it was dutiable at an *ad valorem* rate?
A. It was.
55 Q. You mean by the Government?
A. By the Government.

By Judge SOMERVILLE:

Q. How do you know?
A. I saw returns that were made.
Q. How long did that practice last, so far as you know?
A. During the whole of the *ad valorem* act of 1894 sugars were tested by the U. S. laboratories; all imported sugars were tested and under the method adopted previous to the adoption of the present regulations. Under the former regulations.

By Mr. TINGLE:

Q. These regulations were what?
A. The regulations were based upon commercial methods, as known then and now.

By General Appraiser TICHENOR:

Q. Up to the time of the issuance of the present, they were working under what regulations?
A. Regulations of 1883.

By Mr. TINGLE:

Q. I hand you the regulations of 1883 and wish you to put it in evidence?
A. This was under the act of March 3, 1883, department No. 62, Secretary's office.
Q. Those regulations, as you understand it were in force from the time they were issued up to the date of these regulations of October, 1897?
A. Yes, sir.

By Judge SOMERVILLE:

Q. Any difference, Mr. Sherer, as you understand it, between the method prescribed by these regulations that you have in your hand and the method which you say was commonly adopted in the trade in testing sugar?

A. None whatever.

By Mr. TINGLE:

Q. I hand you also the regulations under the act of August 28, 1894, and desire to have that also marked in evidence?

A. I see no difference between these two. There may be a difference in words, but in general they are the same.

The regulations first produced are marked in evidence Exhibit A, 34769-F, and those last produced and referred to are marked in evidence Exhibit B, 34769-F, December 15, 1898, respectively.

56 Q. Have you made a comparison between the regulations previously in force and those you have in your hand, and the commercial method of testing sugar and the method adopted by the Treasury Department in October, 1897? Are you familiar with the last regulations?

A. Yes, sir.

Q. Have you made any experimental tests for the purpose of showing any results between the two methods of testing?

A. Yes, sir.

Q. Please state what these results are?

A. I have not them with me, but we made a series of experiments by both methods in my laboratory.

Q. Refreshing your memory from this paper (paper handed witness) can you state what difference there is between the two methods of testing sugar in results?

A. The experiments made by us showed an average difference of four-tenths of a degree on pure refined sugar, a sample of which we received from Doctor Wiechmann, the true polarization of which was 99.98. We found the difference to be on the average four-tenths of a degree above the commercial method.

Q. How much above 100?

A. The average above 100 was .276, practically 3/10 of the average of a number of tests.

By Judge SOMERVILLE:

Q. How many tests did you make showing that result?

A. We made ten tests at different dates.

By Mr. TINGLE:

Q. Of the same sugar?

A. Of the same sugar.

Q. Have you made any tests of raw sugar in the same way?

A. My assistant, Doctor Wolfbauer has.

By Mr. GIBSON:

Q. Mr. Sherer, have you any interest in the result of this controversy involving the test of these sugars now before the board?

A. I am employed by the American Sugar Refining Co. to look after their interests in the matter.

Q. Is that as near as you can answer that question?

Mr. TINGLE: If your honor, please, I don't know that that is material what this witness' interests may be.

(Mr. GIBSON:)

Q. Is that all the interest you have in them?

A. In what cases do you allude to?

Q. All these cases.

57 A. No, sir; I am employed by importers to look after their interests.

Q. Does the result of this decision in this case affect the amount of compensation that you will get in these cases?

A. Yes, sir.

Q. In other words, you have a contingent fee, do you, which is concerned in these cases?

A. I have.

Q. Dependent upon the amount that will be recovered by the importers?

A. Yes, sir.

Q. Doctor, do you know whether or not the tests made by the so-called trade chemists and those made by the official Government chemists—do these tests that are made by the trade chemists, are they higher than those made by Government chemists?

A. Sometimes they are, yes.

Q. Do you know about what the percentage is?

A. No, sir.

Q. There are a great many cases in which they are substantially the same, would they not be?

A. Very few.

Q. Now, you spoke of these regulations having been in force since March 3, 1883, or up to the time of the adoption of these new regulations——?

A. Yes.

Q. Well, don't you know that under the regulations in force in 1883, and which you say they followed, that there was a difference that prevailed at Boston and Philadelphia and New York between the tests?

A. No, sir; I never heard that there was any difference really.

Q. Was it not a fact that different results were obtained in Boston than in New York?

A. There was a difference between the chemists in Boston and New York; I understood there was at least.

Q. You were aware that there was?

A. I had nothing to do with it.

Q. Were you in the Government service at that time?

A. I was not testing sugar.

Q. Is it a fact, was there a difference between the tests made at New York and those made in Boston?

A. It was claimed there was a difference. I have very little recollection of that.

Q. You spoke of making a test here of sugar that was delivered to you by Doctor Weichmann—by the Government method—you spoke of that didn't you on——?

A. Dr. Wolfbauer, he is my assistant with me in the laboratory.

Q. Is he here?

A. Yes, sir.

58 Q. Did you make any allowance in that examination by the Government method for temperature?

A. I followed the Government method exactly.

Q. Did you make any allowance for temperature in making that test?

A. Yes, sir.

Q. How much did you allow for change in temperature?

A. I allowed—took the table as prescribed in the table of sugar values.

Q. Kindly tell me what allowance you made?

A. I consulted their table of sugar values and followed their directions: that depended on the temperature at which the tests were made.

Q. At what temperature did you make the tests?

A. In varying temperatures.

Q. From what temperature to what temperature?

A. From about 22 to 35, I think.

Q. You made the allowance for temperature?

A. Prescribed by the table of sugar values.

Q. Did you do it personally?

A. I did it personally.

Q. What quartz plate did you use?

A. A quartz plate graduated by the United States Coast and Geodetic Survey.

Q. What flask?

A. A flask graduated by the same body.

Q. How do you know?

A. I sent my quartz plate to them to be graduated—to be standardized. It was standardized by them and found to be correct.

Q. How about the flask?

A. I also sent a flask, which was graduated by them——

Q. And returned to you? How long before had this been done?

A. Within two or three months. I would like to say that this flask—two flasks were sent from Boston. The quartz plate I sent myself.

Q. Do you know who sent them from Boston?

A. I do not recall. It was the chemist in Boston.

Q. Can you give his name?

A. I cannot give his name; he was employed by the American Sugar Refining Company in Boston.

Q. What value did they assign? Was it on the Mohr flask or the cubic centimetre?

A. You mean the true cubic centimetre. They gave me the value—they found my value to be correct, within 100th of a degree at the temperature of the table which they prescribed, but at 17.5. It was correct. They found my quartz plate to be correct. In other words I don't remember the——

Q. Was it correct—on what basis, on the true cubic centimetre or on the Mohr basis?

59 A. I would like to read the letter I received from the Coast and Geodetic Survey office.

Letter referred to read by witness and offered in evidence by him.

Q. You offer that in evidence?

A. I will also give the letter that I received in regard to the flasks from them if you wish. Two flasks were sent. Number one was found to be correct at 100.07 and the number two found to be 100.06 at 17.05 degrees.

Q. Did they standardize those two flasks according to the Mohr or cubic centimetre?

A. What they call the true cubic or absolute.

The letters referred to by witness are marked in evidence Exhibit C, 34769—F. December 15, 1898.

Q. Do you recognize the U. S. Coast and Geodetic Survey as the highest authority in the United States on weights and measures?

A. Yes, sir.

Q. Did you use the same method, Mr. Sherer, in testing sugars that all the other chemists use?

A. Yes, sir.

Q. Have you been in other laboratories to any extent?

A. Yes, sir; considerable.

Q. Do they all use the same?

A. They have informed me that they do. I have corresponded with every sugar chemist in the United States that I know of.

Q. Are you the chemist for any concern that buys or sells or deals in sugar?

A. I am.

Q. What concern?

A. What they call a sellers' chemist. I test for sellers only.

Q. Don't you ordinarily then test higher than the buyer?

A. No, sir.

Q. How do you know? Have you compared your tests that you have made with the tests of the buyer?

A. I don't compare my test with anybody's test. I make them as nearly accurate as I know how.

Q. Your tests are compared, are they not, with the tests of the buyer?

A. Probably they are after they leave my hands.

Q. Are you cognizant of it?

A. No; may be accidental.

Q. Don't you know as a matter of fact that the tests made on the part of the buyer and on the part of the seller, as a usual thing differ?

A. They very often differ.

Q. And in the same way?

A. No, not in the same way, differ both ways.

60 Q. I mean, the sellers are usually higher than the buyers?

A. That is the general impression. It don't always turn out so.

Q. Is that a fact or not?

A. In the majority of cases they are.

Q. Both use the same methods?

A. But the samples are not the same.

Q. Taken out of the sugar, aren't they?

A. Yes, sir.

Q. Taken out of the same package or bundle?

A. Yes, sir, presumably, yes.

Q. Then they arrive—the buyer and seller arrive at some compromise between the two, don't they?

A. Yes, sir.

Q. And that is the basis of the transaction or sale?

A. Yes.

Q. A polarization is not the test of sale, is it, or basis of sale?

A. Not always.

Q. They buy and sell on a mean, don't they, between the two?

A. Yes, sir.

Q. You use the instrument just the same way in the laboratory that is directed by the manufacturer of the instrument?

A. Yes, sir.

Q. Make no allowance for temperature?

A. No, sir.

Q. What is the average temperature, Doctor, of your laboratory?

A. I should think it was about 22 at the present time, sometimes higher.

Q. What would that be Fahrenheit?

A. About 75, I think. It is a matter of calculation. We use centigrade.

Q. Your temperature in your office would average about 75 degrees?

A. Yes, I think so at present.

Q. What in summer?

A. It runs up to 90.

Q. Now, about what average for the year?

A. I don't know on the average. We don't regard the temperature.

Q. What temperature, Doctor, is your instrument graduated for?

A. Seventeen and a half.

Q. Do you know why that temperature was chosen instead of any other?

A. Because the instrument was graduated at that. Because that

was the temperature selected. Because the temperature of four degrees was impracticable in ordinary work.

Q. Why should it be graduated for any particular temperature?

A. Well, that was found necessary by the makers of the instrument. I leave that to science to explain, as I am not a scien-

61 tist.

Q. You cannot assign any other reason than that?

A. I understand the reason without being able to assign it.

Q. You are familiar, are you not, with the fact that the Government tested sugars under what was known as the bounty act?

A. Yes, sir.

Q. You are familiar with the method which has been in practice at that time?

A. You don't mean the method adopted at present?

Q. During that time—1883—the method was the same as what you now call the commercial method?

A. I understand so, I believe so.

Q. Are you familiar with the method of testing sugars in the Department of Agriculture of this Government?

A. I am not.

Q. Now, Doctor, isn't it a fact that if this matter of allowance for temperature was left out of consideration in these sugar tests, there would probably be no difference between the method adopted by the Government and the results of that which is obtained by what you call the commercial method?

A. That is to say, if the Government didn't add for the difference in temperature, yes, I still think there would be a difference in which the Government method would give higher tests.

Q. That would practically be infinitesimal, would it not?

A. No, sir; it would be quite——

Q. What difference would it make in sugar testing 99.98 by the Government method?

A. Well, it would depend on how much clarifying agency they used in it.

Q. Ordinarily as you have examined——

A. There probably in that case would not be required any clarifying agent to polarize it.

Q. There are cases in which if the temperature was left out of consideration, that the method adopted by the trade and the department—by the Government, would be the same?

A. I say, in the pure, refined sugar like that, if the question of temperature was left out the tests would probably be nearer.

Recess taken till 2 o'clock.

DECEMBER 15, 1898, P. M.

Hearing resumed.

Present: Same as before.

JOSEPH A. DEGHUEE, called as a witness for the protestants, having been duly sworn, testified as follows:

By Mr. TINGLE:

Q. What is your profession?

A. I am a chemist.

62 Q. Of how long experience?

A. I graduated from the School of Mines, Columbia university, in 1890, and since then I have been employed in general analytical laboratories in New York city. Also as private assistant to Prof. Charles F. Chandler of Columbia university for one year, and for the last three years I have been assistant chemist in the New York city food and health department laboratory.

Q. During your experience have you had occasion to study especially sugar chemistry?

A. I have, and took up sugar chemistry as a study in college, and also studied polarized light after graduation. I conducted my work on sugar while assistant to Prof. Chandler and since for the food and health department I have had sugar analysis to do as part of my routine work in the laboratory.

Q. Have you made any recent experiments or investigations touching the methods of testing sugar by the polariscope under the regulations of the Treasury Department as they existed prior to October 27, 1897, and the regulations made after that date?

A. I did not study the regulations as they were prior to 1897. I compared the regulations which were adopted, I believe, in 1897—the new regulations—compared them with the method in use by all chemists in general.

Q. You are acquainted with the general method as used by chemists in general for testing sugar, in New York?

A. I am.

Q. Do you know whether that method has been closely followed by all chemists?

A. That is the method accepted by all authorities that I know of.

By Judge SOMERVILLE:

Q. Do you know whether or not that method which prevailed before 1897 was the one used as a basis of trade?

A. By the Government, do you mean? No I don't. I understood you to say whether I know what the method was used by the Government chemists prior to 1897.

By Mr. TINGLE:

Q. You don't know?

A. I wish to state that I don't know what method was used from personal knowledge.

By Judge SOMERVILLE:

Q. Do you know whether there was any test which was adopted as the basis of sales of sugar in the trade prior to 1897?

A. I know there was such a method.

By Mr. TINGLE:

Q. Will you look at that for a moment (Exhibit B handed to

witness). Will you state whether that is the method pursued
63 by you in making tests, which you understand to be the method used in the trade?

A. It is.

Q. Have you made tests of sugar recently? State whether you have made any recent investigations and tests of sugar by that method and the method pointed out in the regulations of 1897?

A. I have made some investigations under that direction very recently.

Q. Please state what they were?

A. I made a number of examinations——

Mr. GIBSON: One moment——

(WITNESS:)—of sugar by both methods and compared the two.

By Judge SOMERVILLE:

Q. How many tests have you made under both methods, by way of comparison?

A. I made eight separate tests and determinations.

By Mr. TINGLE:

Q. Please state what the result of those examinations and tests were?

A. The material I used was so-called chemically pure sugar—which I tested to discover that it was chemically pure—by dissolving the normal weight, 26.048 grams of sugar to the mark of 100 cubic centimetres, and placed that in the polariscope also 17.5 C. and found that that polarized 100. I took that same sugar and made up my solutions and polarized it at varying temperatures, also making up my solutions and reading at the same temperature and I found the result run invariably above 100, varying from 2/10 to 5/10 according to the temperature——

By Judge SOMERVILLE:

Q. You mean under the Government method now?

A. Under the Treasury method; while under the ordinary method, the results run practically at 100, within one-tenth of 100, as close as any determination could be made.

By Mr. TINGLE:

Q. What flasks did you use in making your tests under the standard or commercial method?

A. I used the true cubic centimetre flask in all cases.

Q. In both cases?

A. Yes.

Q. You didn't use the Mohr at all?

A. I didn't use the Mohr flask at all.

Q. How did you succeed in getting the polarization of 100 since the flasks are so different?

A. By knowing——

64 Objected to.
Question read.

Q. Is the Mohr flask different from the true cubic flask?

A. The volume of the Mohr is different by a different fixed quantity.

Q. How did you get 100 in using the true flask?

A. By knowing the difference between the Mohr flask I can make the correction.

Q. Then you did make the correction, so practically there was no difference?

A. There was no difference in the actual strength of the solution whether I used the Mohr flask or the true cubic centimetre flask. Whenever the temperature was above 17.5 I found that the polarizations by the Treasury regulations run above 100 on every polarization. An average of all my tests, the average temperature would be 23 degrees C.

Q. When you polarize sugar at the same temperature at which the solution is prepared, does the temperature make any difference as to the result?

A. When the solution is made up at the temperature at which it is polarized, the temperature makes no difference, none whatever, which is appreciable on the ordinary polariscope.

Q. In a case of that kind where the temperature is made up,—or the solution is made up at the same temperature at which it is polarized, and the Treasury regulations are followed out strictly, you would add for the difference in temperature?

A. If I followed the regulations.

Q. Well, whenever the temperature were above 17.5?

A. I would add the temperature factor.

Q. Then if there is no difference in temperature, has no effect in other words, you would get an erroneous result?

A. I would.

Q. How much?

A. That would depend upon the temperature. The result would be erroneous by just the amount of the correction which is three degrees.

By Judge SOMERVILLE:

Q. What portion of a degree in the mathematical correction for temperature?

A. It would vary, about three-hundredths of a degree above 17.5.

By Mr. TINGLE:

Q. At what temperature did you make these experiments?

A. From 17.5—varying temperatures, up to 33 C.

Q. How much did you add on the 33 for correction of temperature?

65 A. I first corrected for the use of the true centigrade flask, then I added the difference between 17.5 and 33, multiplied by three-hundredths. I have not the exact correction here.

By Mr. GIBSON:

Q. How old are you, Mr. Deghuee?

A. Twenty-eight.

Q. Where did you get the Government quartz plate that you used?

A. I used two quartz plates, one standardized by the Government, and one that was in use in the laboratory in the American Sugar Refining Co.

Q. Where did you get the one furnished by the Government?

A. From Mr. Sherer.

Q. How do you know it had been standardized?

A. By comparing it with the sugar polarization at 17.5 which read 100, at the same time I took the reading of the quartz plate which corresponded to it.

Q. Did you consider that sufficient identification?

A. I do.

Q. Where did you get the flask?

A. The flask had been standardized by the U. S. Government.

Q. Where did you get the flask?

A. It was handed to me by Doctor Wolfbauer.

Q. How did you identify it?

A. I saw the letter which accompanied it which stated that this flask had been tested by the Government, the same number was on the letter which was on the flask.

Q. Do you know of your personal knowledge that the letter referred to that identical flask?

A. I do not.

Q. Do you understand the Government method of testing sugar?

A. I think I do, yes.

Q. Will you please state it briefly?

A. As set down in the regulations, as I understand the Government method, 26.048 grammes of sugar are weighed out in air, dissolved in water, and put into a flask which contains—whole volume is 100.06 true cubic centimetres. After getting the sugar into solution, a clarifying agent in the form of lead acetate and alumina cream are used and the sugar made up to a mark on the glass bulb and placed in the polariscope and read at the same time the temperature is noted which the regulations specify; the reading is taken of this temperature and noted, then the reading of the quartz plate is taken, then the polari-scope reading of this quartz plate is taken and compared with the table of sugar values, the table giving, I believe, the sugar value of the quartz plate, and a correction is noted on the reading of the sugar solution which corresponds to this difference between the reading of this standard quartz plate and
66 the sugar solution. After this factor of correction has been noted the result is taken as the polariscopic test or polarization of the solution.

Q. Do you add or subtract that correction?

A. If the quartz plate reads higher than the factor given in the table of sugar values, that would mean that the instrument, according to the Government, was reading too high at that temperature and the factor would be subtracted; if the reverse were true, the factor would be added.

Q. Does the temperature have any influence upon the polarization of a quartz plate?

A. It does.

Q. In what way?

A. The temperature of a quartz plate varies if the temperature rises, the reading, that is the rotatory order of the quartz plate will increase as the temperature rises.

Q. How is the polarization of the sugar solution measured in the polariscope in common use?

A. In the Government regulations do you mean by the corrected regulations?

Q. In the polariscope in common use—how is the rotation read?

A. By reading the scale and taking that as the reading.

Q. What has the scale got to do with it?

A. What readings, plate do you mean?

Q. No, I mean the part of the particular instrument that measures the rotation?

A. What it is composed of?

Q. Yes.

A. Composed of quartz wedges.

Q. Then, if the quartz is graduated at 17.5 and the reading made at 25, it would not have the same value?

A. Not exactly, but the difference is so slight it could not be detected.

Q. There is a difference?

A. There is.

Q. How much is it?

A. It amounts to about eleven or twelve one-thousandths of a degree in each degree in temperature.

Q. Then the quartz wedge does not have the same value in different temperatures?

A. Not exactly, no.

Q. It would take less thickness at a higher temperature than low temperature?

A. Yes.

Q. And the sugar solution would read lower at a higher temperature?

A. If the instrument is delicate enough to show that.

Q. Do you use a delicate instrument?

67 A. I use the instrument that is commonly used in sugar laboratories.

Q. Would that be delicate enough to indicate this difference?

A. I do not think so.

Q. Does the sugar solution polarized at different temperatures give the same reading?

A. If made up at the true bulk it does.

Q. Did yours when made up at 17.5 read at that same as when they were made up at 25 and read at 25?

A. Yes, they were.

Q. I understood you to say that there was a difference in tempera-

tures for each degree of temperature—a difference of about three-hundredths of a degree?

A. About that.

Q. That is from your experience?

A. From my experience.

By Mr. TINGLE:

Q. That difference which you have just spoken of, does it appear when you make up the solution at the same temperature in which you polarize?

A. It does not appear in the correct reading. It appears in the corrected polarization according to the Government regulations, not in the true reading of the sugar solution.

Q. Do you regard that as an error in the polarization or not?

A. An error in the——

Q. As erroneous, I mean?

A. The introduction of that factor, I do.

EDWARD WOLFBAUER, called as a witness for the protestants, having been duly sworn, testified as follows:

By Mr. TINGLE:

Q. What is your profession?

A. A chemist and mechanical engineer.

Q. What experience have you had in chemistry?

A. I have had four years' experience in the sugar business in France, and six years in this country.

Q. During your experience in both countries have you become acquainted with what is known as the standard or commercial method of testing sugar?

A. I believe I have become acquainted with the methods in those countries.

Q. Do the regulations of 1894 and 1883 correspond with what you understand to be the commercial test—are they in accordance with the commercial method of testing sugar?

A. They are not in accordance with the——

68 By Judge SOMERVILLE:

Q. You have examined the Government regulations for testing sugar of 1883 and 1894?

A. I have not; those for bounty and those for 1897.

By Mr. TINGLE:

Q. State what you understand to be the method of examination under the standard regulations used in commerce—the standard method?

A. The standard method in one case the Schmidt & Haensch instrument is used and the case in which the French method is used. The Schmidt & Haensch instrument is based on the Ventzke scale which is based on the rotatory action of the sugar made by weighing 26,048 grammes with brass weights in the air, and dissolving the

sugar in a flask that contains 100 Mohr cubic centimetres, clarifying the sugar solution, if necessary with a sufficient amount of clarifying agent, filling up to the mark, and polarizing the solution at the same temperature at which it was made up. The polarization is made in a tube 200 millimeters in length. The reading of the scale furnished by the Ventzke instrument will directly give the percentage of sugar contained in the sample. That is the commercial method.

Q. How does that method differ from the method prescribed by the Treasury regulations?

A. It differs in two ways from the method described. First, the Government requires the use of a flask which does not contain 100 Mohr cubic centimetres, but 100 absolute cubic centimetres, but otherwise the operations are practically the same as this commercial until the end, when the readings are taken of the sugar solution. But a quartz plate is inserted in the instrument, which quartz plate has been furnished by the Government, with a table which shows the different values or changes of the quartz plate according to the temperatures. After the reading has been taken this quartz plate is inserted in the instrument and read, and the thermometer is read which is suspended in the instrument, and the reading, according to the value of the quartz plate for change in temperature, is corrected. These are the two essential differences in the two methods—Government and commercial method. The first difference is, the true flask is changed to an absolute flask, and is corrected for in the sugar table values, and the first correction is introduced for the temperature. That is at least the explanation of the Government method for the ascertainment of the sugar values and the use of the quartz plate.

Q. In testing sugar in both cases, you tested that solution at the same temperature at which it is made up?

A. In both cases.

Q. In that case, what do you say to this statement of correcting for temperature?

69 A. The experiments which I have made—there is no necessity for correcting for temperature. I find that correction for temperature in such cases for any difference of temperature above 17.5 is not called for, it is unnecessary as the sugar will not differ when polarized at the same temperature at which it is made up, in the ordinary limits, I mean, ranging from 12 C. up to about 40 C.

Q. Then there is no error to be corrected on account of temperature?

A. There is none.

Q. Are the same weights used in both instruments, same normal weights?

A. The same normal weight is used; but the Government flasks are graduated to contain 100.06 true cubic centimetres instead of 100.

Q. Did you make some experiments with chemically pure sugar—some tests by both methods?

A. Yes, by both methods.

Q. What was the result of those tests?

A. The result was that the polariscopic readings of the commercial methods, and the Government method, there was a difference, the Government method being between three and four tenths higher.

Q. Did you find that this chemically pure sugar was above 100?

A. The chemically pure sugar tested by scientific tests—and it was 99.98—I experimented to convince myself that it was free from raffinose——

Q. What was the test found by correction for temperature?

A. The test found was 100.3 about, might have been a few one hundredths more, according to the temperature in which it was tested.

Q. What was the minimum?

A. The minimum was 100.2.

Q. The maximum?

A. About 100.4.

By Mr. GIBSON:

Q. Where did you get your quartz plate that you tested with?

A. The quartz plate was returned by the Government to Mr. Sherer. I am a witness that it is the same quartz plate because I opened the box when it was returned.

Q. Did you use that plate?

A. Yes, sir.

Q. In your experiments?

A. Yes, sir.

Q. That the same plate Mr. Sherer has testified about?

A. Yes, sir.

Q. And the same flasks?

A. Yes, sir.

70 By General Appraiser WILKINSON:

Q. You are employed in Doctor Sherer's office, are you not?

A. Yes, sir.

By Mr. GIBSON:

Q. Does the temperature have any influence on the polarization of a quartz plate?

A. The temperature has no influence on the polarization, if the quartz plate and the instrument are exposed to the same temperature.

Q. You don't agree with the other two witnesses—with Dr. Weichmann and Doctor Deghuee? You heard their testimony on that point?

A. Partially, no don't fully recollect.

Q. If they testified that the temperature does influence the polarization of a quartz plate, you don't agree if they so testified?

A. It all depends on what the circumstances are; if you take the polariscopic instrument at the normal temperature, if you keep it at a certain temperature then insert the quartz plate at a varying temperature, then you will get various readings; if the instrument is at the same temperature, you get the same reading all the time.

Q. Can you state whether the temperature does not influence the quartz plate?

A. If the instrument is at the same temperature, then——

Q. No, no, no, as it is ordinarily used.

A. If the quartz plate has got another temperature from the instrument—certainly the temperature has got an influence on the quartz plate to change its reading, it will not read the same.

Q. How much?

A. So far as I am able to observe it was a difference—temperature of about 12 degrees, it was 1/10.

Q. Does an increase of temperature increase the degrees—increase the polarization?

A. Increasing the temperature increases the polariscopic power of the quartz plate.

Q. How is the polarization of a sugar solution measured in the ordinary instrument in use?

A. It is measured by means of a system of quartz wedges.

Q. But the temperature varies and those wedges showing the rotatory power of the sugar vary in different temperatures so that the reading of the solution would vary, would it not?

A. If the solution was of a different temperature, yes.

Q. If you measured a piece of cloth with a yard stick and increased it in length by a higher temperature, it would make a longer piece of cloth?

A. If the cloth were increased to the same amount then you would get the correct measurement.

Q. It would be longer, would it?

71 A. If the cloth increased the same amount in itself.

Q. Does the sugar solution vary in its rotations with the temperature?

A. To my knowledge the variation is extremely slight so far as it concerns the specific rotatory of the sugar solution.

Q. Are you acquainted with a work by the Coast and Geodetic Survey on that point?

A. No.

Q. Are you familiar with a work by Prof. Andrews of the Institute of Technology on that point?

A. Heard about it.

Q. Never read it or studied it?

A. No.

Q. Did you read Dr. Wiley's paper or an abstract of it on that point which was read before the convention at Vienna?

A. Yes, sir, I read it.

Q. What does he state in regard to that?

A. As far as I can recollect he states that the specific rotatory power of sugar does not change to any noticeable extent with temperature.

Q. You never read the regulations of the Government of 1883 on sugar testing?

A. No, I don't think so.

Q. Those of 1897 are the only ones you are familiar with?

A. And those of the bounty law, I saw those *too*.

Q. Those *too* are practically the same are they not?

A. Yes.

Q. You know what the standing is of the U. S. Coast and Geodetic Survey—what its standing is among scientific men as to its being an authority on weights and measures?

A. I am not informed about it.

Q. Do you know it is the official organ established by Congress for this country on weights and measures?

(No answer.)

Q. Are you a partner of Mr. Sherer's?

A. No, I am in Mr. Scherer's office.

EDWARD SHERER, called as a witness for the protestants, having been duly sworn, testified as follows:

By Mr. TINGLE:

Q. State your profession, Doctor.

A. Sugar chemist.

Q. Of how many years' experience?

A. Since 1872.

Q. State how you have been employed.

A. I was in the Government service from 1880 until very recently—first of November this year—and have been em-
72 ployed during that time specifically in charge of the polarization of sugar, connected with the appraisers' office.

Q. Are you familiar with what is known as the standard or commercial method of testing sugar, used generally in the trade?

A. Yes, sir.

Q. Was that method used by the Government in its laboratory?

A. That was substantially the one adopted by the Government in 1880.

Q. Used from that time continuously?

A. Used continuously, up to the recent regulations of 1897.

Q. Did you have occasion while you were in the laboratory, under the new regulations, to make polariscopic tests of any samples of refined sugar?

A. Yes, sir.

Q. About what time were those tests made?

A. They were made at all times when samples of refined sugar were received in the laboratory, not daily, almost daily.

Q. Since the new regulations?

A. In the course of the current work, during the new regulations, as well as under the old, yes, sir.

Q. Did you make those tests strictly in accordance with the regulations?

A. I did.

Q. What was the actual result yielded by those tests of refined sugar?

A. In many cases the polarizations obtained by the Government method was somewhat over 100 per cent.; in very few cases it was under 100. It was, as a rule, very close to 100, sometimes more than 100.

Q. What is the ordinary test of foreign refined sugars?

A. The test of foreign refined sugars, such as we received in the laboratory, prior to the use of the existing regulations, was about 99.8 per cent.; we sometimes got a sugar 99.91 but rarely.

Q. What were the tests under the new regulations?

A. Almost never under 100, sometimes more.

Q. When you spoke of 99.8, did you mean that was the maximum or minimum or average?

A. I should not call it an average. I should say the average would be 99.7; the maximum would be 99.9 I should say.

Q. How high did you ever find refined sugar to test under the new regulations?

A. 100.4.

Q. Were those tests recorded?

A. The test reported was invariably "as over 100 per cent."—when there was a higher reading, the sugar was found as 100.

Q. Why was that?

A. It being manifestly absurd to report sugar as being over 100 per cent., it was not done.

73 Q. Can you give any reason why those extraordinary tests were obtained?

A. I judge it was due to errors attendant upon the system followed in the new regulations, corrections for temperatures and the use of the true in place of the Mohr flask, which was intended to be used with the instrument.

Q. Do you know what the temperature of the laboratory was during the time you were there after the new regulations went into effect?

A. From about the first of June our record was kept out of the temperature at which the polarizations were made. Prior to that time no record was kept. When the new regulations were promulgated the temperature of the laboratory was observed but no record of it was kept until about the first of June, I should say, or possibly a little earlier—June, 1898, I mean, the present year, after the new regulations of 1897 of the present year, along the middle of May, possibly, we began to keep a record of the temperature in our polarizations.

Q. Previous to that, what was it?

A. From the time we received the polariscopes and standard flask and quartz plates from the Coast and Geodetic Survey, the average temperature of the laboratory was about 22 degrees C.; perhaps the extreme 24 and the minimum 20; that was about the average up to the time that the record was kept.

Q. What was the average after you begun to take the record?

A. During the summer the temperature rose at times. The highest record, I think was 33, or possibly 34, but that was exceptional. The temperature ranged on an average of about 27 for the hot months. The records of the laboratory will show how that is.

Q. In your work of testing sugars did you carry out the new regulations strictly?

A. In all essential particulars, I did.

Q. In what respect, if any, did you differ?

A. We found that the use of alumina cream was entirely unnecessary and uncalled for; we did not use it. We did not cover the walls or filtrations with watch glasses. We found that to be impracticable in view of the large number of samples handled daily

and the interference with the work which it would cause. With the exception of those two particulars we carried out the regulations strictly.

By Mr. GIBSON:

Q. Are you familiar with the polarizations of sugar under the act of 1883?

A. I am, sir.

Q. Were you in the Government service during that time?

A. I was in the service when they were adopted and largely framed them myself, so far as they concerned the polarization of sugars.

74 Q. Did you conduct the sugar work in the polarizations at this port under those regulations?

A. I did.

Q. Didn't the comparisons between tests made here at this port under those regulations, and at Boston, show a difference?

A. At one time they did.

Q. And at Philadelphia?

A. As compared with New York the difference was slight. My impression is there was practically an agreement between the ports of Philadelphia and New York.

Q. There was a difference between the tests at Philadelphia, Boston and at New York?

A. There was between the port of New York and the port of Boston and the port of Philadelphia the ports of Boston and Philadelphia were not in accord. The difference between Philadelphia and New York was less than the difference between Boston and New York; but the three ports were not in accord during a period of one or two years, I think along about 1885.

By Judge SOMERVILLE:

Q. Do you know what the difference was caused by?

A. I think I do, yes, sir; due to the error of the chemist in Boston in valuing his quartz plate, assuming that its mark which was 99.1—2 meant 99 and one-half, or 99.5; whereas, when that plate was examined, it was found to have a value not exceeding 99.10, the meaning of 99.1—2 being 99.2, that was mainly the cause of the difference.

By Mr. GIBSON:

Q. Was there not a difference between the same samples tested here and those tested at Boston?

A. There was, yes.

Q. That was as much as 6/10 per cent.?

A. My recollection is that the difference was from four to five tenths; it may have reached 6/10; the average difference was not more than 4/10.

Q. Didn't that difference continue for more than a year?

A. I should judge it was, about a year.

Q. The quartz plate was changed at Boston?

A. A different plate was used.

Q. Didn't that difference continue after that quartz plate was taken away?

A. I was out of the Government service about 18 months and what happened then I have no knowledge in regard to the matter. When I returned to the Government service I do not recall that there was any material difference, until perhaps the year—in the year 1890, there was an investigation which developed a difference be-
75 tween the port of New York and Boston. I think it was thoroughly investigated at the time.

Q. What was the difference at that time to which you have just referred between New York and Boston?

Mr. TINGLE: I wish to ask your honor, if this is not all immaterial?

Q. Did not these differences exist in 1890 and 1891?

A. In 1890, they did. May I be permitted——

Q. That was after the removal of the plate, was it not?

A. That was after the removal of the plate.

Q. What was the trouble then?

A. They were attributable to the mistake on the part of the Boston experts in using the true cubic instead of the Mohr flask; the same cause which produces the difference at present between the old and the new regulations.

Q. Where did they get the flask?

A. Doctor Leary standar-ized his flask himself and adopted the true cubic centimetre. The report of Mr. Titmann will explain these differences.

Q. The true cubic centimetre flask could be used under those regulations?

A. Not properly.

Q. Not properly; was there anything in the regulations to prevent it?

A. The regulations did not prescribe the true flask or the Mohr flask. They prescribed the making up of the solution to 100 cubic centimetres, but the instrument had been standardized to the Mohr, and it was understood that it was the flask to be used in testing sugars at that time.

Q. They followed the regulations—Doctor Leary?

A. I don't think he did.

Q. Strike that out. Then you noticed that there was a different polarization of the same sugar at different temperatures?

A. I cannot say that I have under the proper conditions. These polarizations have been made at the same temperature at which the solution is prepared. In that case I have observed no difference in the result at varying temperatures.

Q. Does the temperature have any difference upon the polarization of a quartz plate?

A. Undoubtedly; I should say it would have some difference upon the polarization of a quartz plate, or the value that it would have.

Q. In what direction, Mr. Sherer?

A. My impression is that the polarization would be some higher by the increase of temperature.

Q. How is the polarization measured in the ordinary instrument?

A. I don't understand the question.

Question read.

76 A. By the reading obtained when the sugar solution is placed in the instrument. If you will permit me to explain on this matter of the change in the value of the quartz plate or reason of the change of the temperature, I should like to say that I consider that fully compensated in the quartz plate in the instrument. The instrument has compensating quartz wedges, right and left hand, and while it is true that the value may change by any change of temperature, the change would be compensated, under the circumstances.

Q. There is no quartz plate in the instrument—in the sugar solution?

A. The instrument is constructed with quartz plates, right and left hand, except for the purpose of standardizing your instrument, it is read through the quartz plate.

Q. How do you measure the rotation of the sugar solution?

A. By the degrees recorded on the scale, in looking through the solution at the glass, when we have obtained the equalization of colors.

Q. What do you move, or what—when you move the milled head screw—that increases or diminishes the thickness of the wedges?

A. When there is nothing in the instrument and the quartz wedges which are in front, one right and the other left, turning the milled head, in effect is to get the neutral tint in the sugar solution. When the equalization is adjusted and with two very distinctive shadows, it becomes necessary to diminish the thickness of those wedges in front in order to reach the neutralized field again. With that point reached our scale will show what the polarization of that sugar solution is. One hundred should be the value observed for pure refined sugar.

Q. Then you measure that solution by quartz wedges, do you?

A. Well, quartz wedges are essential to the construction of the instrument.

Q. Don't you measure the rotation by quartz wedges?

A. Yes, I should say you did.

Q. Don't that wedge vary in rotation in different temperatures?

A. We measure by two quartz wedges——

Q. That is not the question. Read the question, will you please (question read)?

A. An answer yes or no would convey a wrong impression; there are two quartz wedges, one right hand and the other left, and a change of temperature would be compensated for so that a change in temperature does not effect the reading.

Q. Do you move both wedges?

A. Practically we move one wedge; the two wedges in the front of the instrument are both of the same variety of quartz; but in the rear of the instrument there are two which are not the same variety; one is right and the other is left hand.

Q. Which do you move, the back or front wedges?

A. One slides over the other.

77 Q. You only move one wedge?

A. Moving one wedge increases or diminishes the thickness of the two.

Q. If the temperature increased the rotation it would take a less thickness, would it, to measure the solution or rotation?

A. I do not think I stated that the temperature increased the rotation.

Q. Didn't you state that this temperature increased the polarization? I so understood you?

A. It diminishes the polarization of the sugar solution. I have not observed the effect of the change of temperature on the quartz plates. I have not made any experiment which would show whether they changed. I am speaking from general recollection as far as they are concerned.

Q. Then you admit that with a decrease in temperature the polarization of a sugar solution would be affected?

A. Not if it is made up and polarized at the same temperature.

Q. Tell us if, in your opinion, the temperature increased the polarization of the quartz plate?

A. I have made no experiments which would enable me to answer that question at all. I rather not trust to my memory. It was an impression and I give it for what it is worth. As a matter of fact I don't know.

Q. Is it not so stated in all authorities on quartz plates?

A. At the present moment I am unable to say. I really do not know.

Q. Have you read Doctor Wiley's book? Isn't it so stated in that? Have you read that?

A. I have not read Doctor Wiley's book.

Q. Do you know about the office of the U. S. Coast and Geodetic Survey and weights and measures?

A. Yes.

Q. What is its standing among scientific men?

A. It is certainly the highest authority on the question of weights and measures, I should say.

JOHN HOWARD WAINRIGHT, called as a witness for the protestants, having been duly sworn, testifies as follows:

By Mr. TINGLE:

Q. What is your profession, Doctor?

A. I am a chemist.

Q. Have you been in the Government service?

A. I have about 15 years, until the latter part of last April.

Q. Were you cognizant of the preparation of the regulations of the Treasury Department of October 27, 1897—the new regulations in regard to testing sugar?

A. I was.

78 Q. Were you called to Washington to consult in regard to these regulations?

A. I was.

Q. Did you at that time call the attention of officials of the department to what you regarded as erroneous methods for testing sugars, proposed by the regulations?

A. In general.

Mr. GIBSON: One moment, I object to that.

Objection sustained.

Q. What do you regard as the——

By Judge SOMERVILLE:

Q. Are you familiar with the department regulations of 1883 to 1894——

A. I am.

Q. On this subject?

By Mr. TINGLE:

Q. And of 1897, the recent regulations?

A. Yes, sir.

Q. You are familiar with the difference between the regulations of 1894 and 1897, are you?

A. I am.

Q. Have you ever made any tests under those?

A. I have made a great many tests under the regulations in force prior to the present regulations.

Q. Did you make any under the present regulations?

A. I did.

Q. From your perusal of these new regulations what, in your opinion, are the sources of error, or errors, in them?

Objected to; question withdrawn.

Q. Give us your opinion as an expert—are these regulations of 1897, are they defective?

A. I should say they were defective.

Q. In what respect?

A. Well, first, the Government regulations prescribe a method to be pursued in making up the solution that is a different method from the one upon which the graduation of this scale of the instrument is based. Secondly, from the prescribing of the introduction of a correction under conditions which the regulations themselves take very good care to provide against; namely, the correction for temperature. Those are the chief sources of error which were to my mind and are quite apparent.

Q. When you spoke of against such error, you referred to what?

A. I refer to the very part of the method in which the regulations lay down a rule that all the operations in making up the test which lead up to the final observations in the tube in the in-

79 strument itself. The regulations prescribe that the difference of temperature shall be guarded against in the making up of the solution under the same conditions of temperature, notwithstanding, they further provide that a correction shall be made for any temperature difference over 17.5 degrees C.

Q. In other words, a correction is made for an error that don't exist?

A. It so appears to my mind.

By Mr. GIBSON:

Q. Now, Doctor, you have stated here, as I understand you to say the temperature is taken all through in the operation or testing the sugar at one temperature?

A. I don't recall?

Q. That the temperature is the same during the whole operation?

A. If the regulations are followed out as laid down.

Q. Isn't it a matter of fact that they prescribed that the instrument is graduated on a test of 17.5?

A. I don't understand your question, Mr. Gibson.

Q. It is graduated to that temperature by the makers?

A. Yes, that is quite correct.

Q. Isn't that a very much lower temperature than the temperature of the room as it is connected in the appraiser's office in this building?

A. At certain seasons it is.

Q. Is there any season of the year when it is as low as that?

A. In this building?

Q. Yes?

A. I am not familiar with the present laboratory and the working conditions. I have not been in the service since they occupied their present quarters. My recollection is of the old laboratory.

Q. I understood you to say that the departure had been in the use of a flask that is different than the one formerly used?

A. That is one of the changes.

Q. You think that ought not to be done?

A. I beg your pardon?

Q. You think that should not have been done?

A. I can see no good reason. It introduces a serious error.

Q. Why do you admit the departure from standard temperature and insist upon the standard flask?

A. Will you repeat the question?

Question read.

A. Why the standard temperature will have nothing to do with it then your factor of temperature is eliminated.

Q. Why do they standardize at 17.5?

A. Simply as a convenient temperature at which the flask, the wedge and the solution and the instrument itself are graduated would be the same. They could use any other temperature, provided the temperature was uniform throughout.

80 Q. Don't those people—the makers recommend that all these tests be made at or near that temperature—17.5?

A. Why, they do, it is a mere recommendation, however.

Q. Why do you suppose they do it?

A. I understand a recommendation of that kind would mean that the operation should all be done at or in a room in which the temperature is about 17.5. In this country it is sometimes higher.

By Mr. TINGLE:

Q. It is all surmise.
A. I am asked to surmise.

By Mr. GIBSON:

Q. Does the temperature have any influence upon the polarization of a quartz plate?
A. I don't understand what you mean by the term polarization used in that sense.
Q. Does varying temperature vary the polarization of the quartz plate?
A. You mean the specific power of quartz——
Q. I mean the rotation?
A. The rotation would depend upon the observation in the instrument itself. It would go with the instrument. The quartz plate and the instrument would go together.
Q. Does the rotation of the quartz change with varying temperature?
A. It does.
Q. Which way?
A. It rests with the temperature, to an extent entirely imperceivable in the ordinary polariscope.
Q. Why do you think it is imperceivable?
A. Simply from my knowledge of the instrument and its limitations and the very small amount of increase in rotatory power with the standard furnished and known to any scientific men.
Q. Do you know the formula for the variation of quartz at different temperatures?
A. I have not; I do not pretend to carry formulas in my head.
Q. Do you know how they measure the rotatory power of a sugar solution in the reading of the instrument?
A. I do.
Q. By what means?
A. By means of two quartz wedges of different thickness which slide across each other; one affects the scale, the other don't.
Q. Do they both slide?
A. In some instruments; in the present they don't.
Q. Do they slide in use in laboratories commonly?
A. One does, one is; the other is fixed.
81 Q. One slides, the other remains fixed?
A. Yes.
Q. One is moved for a higher rotation at a higher temperature?
A. I don't know why it should be a higher rotation than the other fixed; they are the same material.
Q. They are higher than in the lower are they not—does not the movable wedge have a higher rotation than at the lower?
A. Why, yes; it is so small it does not affect the instrument. It is a matter of opinion, as a matter of fact.
Q. Is the solution not measured by that wedge—the rotary solution?
A. In a measure.

Q. If it has a higher rotation it takes a less thickness, don't it?
A. That would be compensated by the other parts of the instrument.
Q. The other, you stated, doesn't move?
A. Yes.
Q. It starts from zero?
A. Yes.
Q. Therefore, no compensation could be made?
A. Certainly, because the other would not have to slide so far.
Q. I understand you to say that the present regulations were erroneous; you know whether or not those were approved by the Coast and Geodetic Survey?
A. I was so informed.
Q. Do you know what the standing of that body is among scientific men of the world?
A. It is regarded as a standard by law. As a matter of law it is the standard.
Q. How is it regarded by scientific men outside of law?
A. In some respects it would be considered; in other respects it would depend upon the individuals who did the work.

R. W. MOORE, called as a witness for the protestants, having been duly sworn, testified as follows:

By Mr. TINGLE:

Q. You are the chemist in charge of the laboratory of the appraiser's office?
A. I am.
Q. Are you familiar with the workings of the regulations of October 27, 1897, as regards the testing of sugar?
A. I am.
Q. Have you tested samples of refined sugars in the laboratory since those regulations went into effect?
A. Samples have been tested in the laboratory since; yes, sir.

82 By Judge SOMERVILLE:

Q. Under your supervision?
A. Under my supervision.

By Mr. TINGLE:

Q. Can you tell us the results of some of those tests?
A. They have always been reported at from 99.7 to 100, the results as approved and forwarded by me.
Q. The actual results?
A. Some of the observers have claimed that they have read higher to the extent of a tenth or so, but as it was manifestly impossible, the sugar was not reported at over 100 per cent.
Q. When you say "a tenth or so," what do you mean? What would be the maximum?
A. I do not know what the maximum would be.
Q. Who made those tests?
A. The various polariscopists in the laboratory.

Q. You are not familiar then yourself with the——

By Judge SOMERVILLE:

Q. The particular tests, figures reported to you by these parties come under your supervision?

A. They do. In very many samples they found a higher test—run over, they told me.

Q. Say how much over?

A. Not definitely, no.

By Mr. GIBSON:

Q. Doctor, isn't it possible for the different observers to make a difference in the reading of 2/10 in the reading of the instrument?

A. Certainly, it is possible.

Q. So a sugar that was only 100 might be read by some below or as high as 100.2?

A. It is possible. On sugars of very high grade, like refined sugars, they — generally all closer.

By General Appraiser TICHENOR:

Q. Is that frequent that an examiner would report his test higher than 100?

A. Yes, it was reasonably frequent. We don't test very many refined sugars. They would say that "we find it to be over 100."

By Mr. TINGLE:

Q. What is about the average test of refined sugars heretofore under the old system of testing; I mean of foreign refined sugars?

A. It is very seldom that we are called upon to test foreign refined sugars. Most of those that we do test are domestic, for drawback purposes. I am not in possession of any figures on very
83 high foreign sugars tested at this port. It was exceptional when they were tested.

Q. These sugars you spoke of a while ago, foreign or domestic?

A. Most of them domestic sugars. Sometimes I think some samples of sugar which were brought into the laboratory for exceptional purposes have been uniformly tested.

Q. Fine sugars are imported at this port?

A. Yes, sir.

Q. They are required to be tested?

A. I really don't know; I think they are generally tested.

Q. They are?

A. I aim to look after our end of the laboratory. We take the samples and test them.

By Mr. GIBSON:

Q. Do you know whether or not there is any prejudice among the observers against these new regulations of the Treasury Department?

A. It would be very idle and useless. If they are they are kept from my observation. If it was discovered I should report it, for they are a part of the Government regulations and we are bound to obey them cheerfully.

Q. Isn't there an unfriendly feeling towards these new regulations among those who execute them?
A. No, I should not say so.

4 p. m.—Hearing adjourned until 10.30 a. m., December 16, 1898.

DECEMBER 16, 1898—10.30 a. m.

Hearing resumed pursuant to adjournment.
Present: Same as before.

EDWIN A. ZELLER, JR., called as a witness for the protestants, having been duly sworn, testified as follows:

By Mr. TINGLE:

Q. Will you give your name please?
A. Edwin A. Zeller, Jr.
Q. Where do you reside?
A. Philadelphia,
Q. What is your business?
A. I have charge of the raw sugar department of the Franklin and Spreckels refinery.
Q. How long an experience have you had in the sugar business?
A. About 16 years.
Q. Buying sugar?
A. Most of that time in the buying department.
Q. How are sugars bought, with respect to test?
A. Sugars are bought on their polariscopic tests.
84 Q. How is that polariscopic test obtained, so far as the buyer and seller are concerned?
A. The merchant buying sugars on polariscopic tests, understands it to be that percentage which would be certified by a public chemist on samples that are submitted to the public chemist.
Q. Are the certificates of public chemists or polariscopists always received in the trade as the correct test of the sugar?
A. Yes, sir.
Q. That test is known as the commercial test?

Mr. GIBSON: I object to that as leading.

Q. I will put it this way: How is that test known?
A. As the polariscopic test.
Q. As the polariscopic test?
A. Yes, sir.
Q. Does that custom prevail generally in the trade?
A. Yes, sir.
Q. Throughout the country?
A. I understand so; yes, sir.

By Judge SOMERVILLE:

Q. How long has that been the case?
A. Since I first went into the sugar business, about 16 years ago, sugars have been bought and sold on the sample as tested. That has

been the practice since the polariscope became of use for all transactions in sugar.

Q. Is there any particular method of testing by the polariscope in use?

A. My understanding of the matter—I am not a chemist—was that there was a system—the same system used by all chemists, all public chemists.

By Mr. TINGLE:

Q. Were you present some little time ago at a conversation between Doctor Wiley and Mr. Craig of Philadelphia?

A. Yes, sir; if you refer to the meeting of the commission at which Dr. Wiley was present——

Mr. GIBSON: I object——

(WITNESS:) In the appraiser's office last May, I was there.

Judge SOMERVILLE: What do you propose to show by that?

Mr. TINGLE: If your honor please, my desire is to show that Doctor Wiley has advised persons engaged in selling sugar in the sugar trade, to follow or adopt the method which has been prescribed by the Treasury regulations.

Judge SOMERVILLE: It would not be competent to prove that if it is objected to by the Government.

85 Mr. TINGLE: I withdraw the question.

Mr. GIBSON: I have no objection.

Mr. TINGLE: You can answer the question.

A. At that meeting of the commission I heard Doctor Wiley and Doctor Crampton.

Q. State what commission?

A. A commission that visited Philadelphia in the matter of investigations of complaints that had been made in regard to the tests returned by the Government——

Q. The workings of the new regulations?

A. Yes, under the new regulations. At that conference I heard Doctor Wiley say to Mr. John F. Craig that, if the merchants would adopt the system that was according to the new regulations, that it would be to their interests, because it would give the merchant—that is, the sellers—a better result, higher test. That was the substance of the conversation.

By Mr. GIBSON:

Q. Are you connected with a firm in the sugar business?

A. I am employed by the Franklin and Spreckels Refining Co.

Q. What is your department—business in that concern?

A. The raw sugar department, I have charge of, particularly the examination of the test of sugars, as returned by the public chemist.

Q. You have what you call public chemists, in Philadelphia?

A. Yes, sir.

Q. How many?

A. There are several. Mr. Terry——

Q. They test for any person that employs them?

A. Yes, sir.

Q. Does your concern have a special one?
A. No, sir.
Q. Is your concern a buyer or seller?
A. Buyer of raw sugar and seller of refined.
Q. You see the tests of your chemist, or the chemist who makes the test for you?
A. Well—yes, sir.
Q. You see the test of the chemist from whom you buy the sugar?
A. I don't understand. We don't buy the sugar from the chemist.
Q. You buy the sugar from some one. You understand the seller has any test made of the sugar?
A. There are two tests taken; the samples are submitted to two public chemists; one chemist is paid for by the buyer—certificate, rather—and one certificate by the seller.
Q. You see those tests?
A. Yes, sir.
Q. In how many instances have you seen those tests of the samples of raw sugar?
86 A. I have seen a great many.
Q. As a rule those two tests differ, don't they?
A. Not materially.
Q. They do differ?
A. Sometimes.
Q. Did you ever see them when they were identically the same?
A. Quite frequently.
Q. What proportion?
A. Well it would be difficult to state a proportion.
Q. Once in every five times, are they alike?
A. Well, I should think they would vary from—rarely more than once in five times.
Q. Would they be alike once in seven times, do you think?
A. Yes, I think an average——
Q. You think on the average they would be——

By General Appraiser TICHENOR:

Q. Oftener than five times or not so often?
A. Well, the variations are slight between the chemists. Sometimes the seller's chemists, or the public chemist's certificate paid for by the seller, will run under the test of the chemist whose certificate is paid for by the buyer; and sometimes the seller's tests will run higher; they vary sometimes a tenth to two tenths, over and under.

By Judge SOMERVILLE:

Q. About what proportion of these analyses, as far as you can remember, of the tests of the sellers' chemists, and that of the buyers' chemist, agree, substantially?
A. It would be difficult to state.
Q. Are you able to state?
A. I would not be able to state and give a percentage. I have not examined that matter carefully. I would not like to make an estimate.

By Mr. GIBSON:

Q. You say that the difference is very slight. What is the greatest difference that you remember between the tests made by these chemists?

A. I have seen large differences occur because of variation in sample.

Q. What was the difference, the largest one?

A. I have seen the difference run up to 7/10.

Q. They run as high as that?

A. I am saying what I have seen. That is exceptional. I have seen such.

Q. They take their samples, as a rule, from the same casks, from the same quantity of sugar, do they not, as a rule?

87 A. The buyer has a sampler and the seller has a sampler. They are supposed generally to take samples of the cargo.

Q. Practically, they test from the same samples, do they not?

A. Not exactly, no, sir.

Q. Now, then, the buyer don't buy by the seller's samples and the sellers don't sell by the buyer's samples?

A. The buyer's sample is mixed and submitted to the public chemist and the seller's sample is submitted to the public chemist.

Q. They don't—one don't buy or sell by each other's tests do they?

A. That is by settlement—by the result reached by both.

Q. Compromise, or arrangement between the buyer and seller of the sugar. The sale is made on a compromise test as to what each one will buy by and sell by?

A. The settlement is made on an average test.

Q. Do they add the two tests together and divide them by two, or is there any rule?

A. It is generally effected by an average.

Q. Yes, you mean they add them together and divide by two, or what is the average?

A. That is the way the average is effected.

Q. Is there more than one average?

A. Of course that depends upon the units represented by the sample.

Q. Then the buyer of the sugar does not buy by either one of these tests, does he, absolutely?

A. Take the previous——

Q. No, no, no; please answer my question. Does the buyer buy by either one of these polariscopic tests where they differ?

A. No, they buy on the average test.

Question read; answer read.

Q. You mean to say that they buy on the compromise reached by the two—you mean by compromise?

A. I don't know as it is a compromise; it is the method of the business.

Q. Now, is there very much pure sugar imported into this country?

A. There is a great deal of raw sugar.

Q. I am speaking of pure sugar, as it is called, pure sugar?

A. I don't know. There is considerable foreign granulated sugar imported into this country, and a great deal of raw sugar imported which of course does not test 100.

Q. I mean what is called pure sugar; is there much of that imported.

A. I don't know of a great deal of sugar other than the granulated. I don't know of any sugar which would approach the
88 question that you ask except the foreign granulated. My understanding is, that don't test 100 degrees purity.

Q. You don't know anything in regard to making these polariscopic tests, except what you are informed?

A. Except in a general way.

Q. Do you know whether or not the Government makes a polariscopic test from the same samples that the buyer and seller do?

A. They don't.

By General Appraiser WILKINSON:

Q. In taking samples, have you noticed whether or not there was any tendency on the part of the sellers to select a better sample than the buyer does?

A. Naturally the man employed by the seller is anxious to get all out of his sugar that he can; supposed to be his business.

Q. Do you think the tendency is for the seller's samples to be better than the buyer's?

A. That would reflect credit on his ability naturally, he is seeking that.

By Mr. GIBSON:

Q. Is it not a fact that the Government tests—that the buyer's tests are sometimes higher than the Government tests?

A. Well, I noticed in Philadelphia, up to about the first of January, that a number of importations of ours, our settlement test was a little higher, some higher, three or four-tenths higher than the results obtained by the Government. I noticed immediately a change was effected in Philadelphia in the method of polarizing, and that the Government tests always run higher than the settlement tests.

Q. Always? No instance that you know of in which the Government tests were lower than the settlement test?

A. I don't know; I might say with one exception—which is claimed as a variation in the sample, that the Government run lower than the settlement, after the change was made.

Q. That is the only one case that you know of?

A. That is the only one case that I can recall.

By Mr. TINGLE:

Q. The samples taken by the buyers and sellers, are the- identical, or do the samples differ? Does the buyer take one sample and the seller take another?

A. The buyer draws samples and puts them in a tin; the seller draws a sample and puts them in a tin.

Q. There may be a difference in the two tests, due to a slight difference in the sample?

A. There may be.

89 Q. Different buyers and sellers employ these public chemists indiscriminately. That is, the chemist might test one sample for the buyer, then another sample for the seller?

A. The same chemist would not know that the goods or cargo were for a buyer or seller.

Q. I mean they are employed indiscriminately, the chemists?

A. It very frequently happens with us in Philadelphia, the seller would employ a chemist for a cargo and we might employ the same chemist.

ERNEST W. CHAPMAN, called as a witness for the protestants, having been duly sworn, testified as follows:

By Mr. TINGLE:

Q. What is your name?

A. Ernest W. Chapman.

Q. What is your business?

A. Examiner.

Q. What is your work?

A. Testing sugar.

Q. Do you make tests for the Government under the present regulations?

A. Yes sir.

Q. Have you tested refined sugars under those regulations?

A. Yes, sir.

Q. Have you in the course of your testing work, in testing refined sugars, found those sugars to run more than 100?

A. Yes, sir.

Objected to.

Question withdrawn.

Q. Please state what results you have found in tests of granulations of sugars, since these regulations have been put into effect. I mean since the regulations of October 27, 1897 went into effect, what results have you found in respect to the testing of refined sugars?

A. We found that the tests run 99.7 to 100.2 or three tenths.

Q. How many cases have you found in testing foreign sugars where the tests run over 100?

A. About thirty per cent., one hundred, or over.

Q. Does the record show that they tested over 100?

A. No, sir.

Q. What does the record show?

A. One hundred.

Q. Why do you put on the record that the test was one hundred?

A. I didn't think it would look well to report them.

Q. What is your experience with regard to testing the same character of sugars under the previous regulations?

A. Seldom we had a sugar tested over one hundred.

90 Q. Did you ever have any that tested over one hundred?

A. Not that I recall.

Q. What was the highest average?

A. About 99.8 possibly.

Q. Did they average that?

A. I think so.

Q. On foreign sugars?

A. Very few.

Q. Do you understand that foreign refined sugars, such as come to this port, imported from Germany and Austria, tested 99.8?

A. I don't know anything about it, sir.

Q. Don't you test any of that character?

A. I could not say whether they were domestic or imported.

Q. You don't know the origin of the sugar?

A. No, sir; I don't.

By Mr. GIBSON:

Q. Do you test many refined sugars?

A. I have lately, yes.

Q. Do you know whether or not they were beet or cane sugars?

A. I do not, sir.

Q. What are the permissible variations of polarizations?

A. Three tenths, I should say.

Q. Could a pure sugar stand over 100 within permissible errors?

A. I think it possible.

Q. Have you been in the department here, having charge of sugars, prior to these new regulations?

A. Not having charge of sugar, no, sir.

Q. Did you have anything to do with the sugar prior to July 24, 1897?

A. Yes, sir.

Q. For how long a time?

A. Different intervals for the last 19 years.

Q. Not regularly?

A. Not regularly, no, sir.

Q. Have you not read sugar under the old regulations over 100?

A. No, sir; I didn't read a sample of pure sugar.

Q. That is why you never read over 100?

A. That is why I say I never did.

By Mr. TINGLE:

Q. Mr. Chapman, what is the practice in the laboratory in regard to the tests, where one operator makes a test and another makes a different reading from the first one taken; what is the manner of doing that?

A. Each man reads his tube, marks the number down on the ticket. The result must agree within three-tenths per cent.; if not——

Q. That is the same sample?

91 A. Yes, sir; if not, we make a re-test, and if it is more than 3/10 we make a third test.

Q. What test is taken?

A. The average of the two most closely agreeing. I report the tests to the 8th division.

Q. They take the average test?

A. I suppose they do.

Q. Are those readings of the same solution, or independent?

A. Independent solutions.

W. E. DICKSON, called as a witness for the protestants, having been duly sworn, testified as follows:

By Mr. TINGLE:

Q. What is your business?

A. Examiner in the appraisers' department.

Q. What work do you do?

A. Sugar work, general chemical work there.

Q. You test sugars?

A. Yes, sir.

Q. Have you been testing sugars under the regulations of October 27, 1897?

A. Yes, sir.

Q. Have you followed those regulations strictly?

A. Yes, sir.

Q. Do you use alumina cream as a re-agent for precipitating the solution?

A. Yes, sir; not always. Sometimes we have not used it.

Q. Well, do you use it at the present time in the current work?

A. Yes, sir.

Q. Have you had occasion to test any refined sugar under those regulations?

A. Yes, sir.

Q. What has been the result?

A. Well, with two of us reading I don't remember. I could not swear that my own was over 100 or not without looking it up.

Q. Were the readings of any of those over 100?

A. I think we had them go over that.

Q. Is it in your opinion possible that a sugar correctly tested should read over 100?

A. Well, it oughtn't to be.

By Mr. GIBSON:

Q. What are the permissible variations——?

A. Three-tenths of a degree.

Q. Any sugar that is over 100, that is pure, might be read over three-tenths, it would be permissible under the regulations of the customs?

92 A. It would under the regulations, yes, sir.

Q. Do you test much refined sugar?

A. No, I don't have very much refined sugar in Philadelphia.
Q. That is a small portion, is it not?
A. Yes, sir.

By Mr. TINGLE:

Q. What do you understand to be the meaning of the 100 degree mark on the polariscope?
A. I don't know as I understand that question.
Q. What does the 100 mark mean? What does it indicate in the polariscope?
A. Pure sugar.
Q. Chemically pure sugar?
A. Yes, sir.
Q. How can there be anything purer than chemically pure sugar?
A. I don't know that I ever saw chemically pure sugar. I should not——
Q. Then if chemically pure sugar tests 100, how can any sugar show on the polariscope as testing 100.3, if it is properly tested by the polariscope?
A. The operator may have made a mistake; may have gotten too much sugar and not enough water in his flask.
Q. I am speaking now if it is done properly and the operation has been—— ?
A. It oughtn't to test 100.
Q. Now, is granulated sugar that is tested ordinarily—what is the ordinary test of granulated sugar that comes under your observation?
A. Somewheres around 99.8 or nine.

By Mr. GIBSON:

Q. Do you know whether there is any such thing as absolute-pure sugar in science?
A. Pretty hard thing to get.
Q. Would not absolutely pure sugar be purer than what is known as chemically pure sugar?
A. Repeat that question?
Question read.
A. I have heard of sugar being called chemically pure sugar. I don't know as I ever saw a sample of it.
Q. Chemically pure sugar is not absolutely pure? Is that your answer?
A. Pretty hard to get a thing absolutely pure. It ought to test just 100.

Judge SOMERVILLE: Have you any more witnesses to call for the protestants, Mr. Tingle?
93 Mr. TINGLE: I should like to reserve the right to call one witness later, if your honor pleases.
Mr. GIBSON: Then I submit to the board that protestants have not produced any testimony before this board to justify this board

to go into any examination of this subject at all. They have not shown that they have paid a higher rate of duty in any case, and that all the testimony on the part of the protestants has simply been an attack—an attempt to show the difference between the tests made by private parties of sugar and that made by the Government authorities—officers under the law—that being a matter of measurement and no errors shown, the position of the Government is unassailable, and that there has been no specific case presented under which there has been shown a right to claim a refund of duty.

Mr. TINGLE: It is unnecessary for me to answer that.

Judge SOMERVILLE: Call your first witness, Mr. Gibson.

Mr. GIBSON: I will call Mr. Chance.

W. S. CHANCE, called as a witness for the Government, having been duly sworn, testified as follows:

By Mr. GIBSON:

Q. Mr. Chance, where is your residence, and what is your occupation?

A. I reside in Washington, supervising special agent of the Treasury Department.

Q. How long have you been such officer?

A. About a year and a half. Prior to that time I was special agent, having been in the service about 18 years, all told.

Q. During the time that you have been in the Government service, as such officer, have you had anything to do with the testing of sugar, or with the duties upon sugar?

A. I have had considerable in the past to do with the administration of the sugar schedule of the different tariff acts.

Q. Will you please state the reasons, if you know, that led to any alterations or modifications, or corrections, of the errors in the regulations of 1883 and 1894, resulting — the present regulations of 1897?

A. In 1889–90, I was assigned by the Secretary of the Treasury as a member of a commission, charged with the investigations of the alleged *or* irregularities or methods, as conducted by customs officers at the ports of New York, Philadelphia and Boston; at which time Col. Tichenor was Assistant Secretary of the Treasury. Col. Spaulding, Col. Montgomery and myself constituted that commission. We instituted a series of comparative tests, and a daily exchange of samples, between the three ports, Philadelphia, New York and Boston, and kept unknown to the public—results at that time were unknown—those tests were made daily and a compari-

94 son was made of the different tests. Those tests covered a period of nearly six months, in fact were continued by the department after that. The results showed conclusively that the tests at New York averaged 6/10—according to the daily record of tests of the same sugar—below the average made by the chemists at Boston and Philadelphia, and that the tests at Philadelphia and Boston were in practical accord, that is, within 1/10 of each other, on the average, and not as has been stated wider apart, as was

stated yesterday, I think. When we completed this part of our investigations, having carried on these comparative tests for a sufficient length of time to ascertain that there was an average difference of test at New York, as I have stated, being on the average 6/10 lower than the other two ports—that meant that the sugars paid 6 10 of one per cent. less duty—Doctor Sherer who was then the chemists in New York—Doctor Edward Sherer—who was then the chemist, was then confronted with the results—with the results of our investigations——

By Judge SOMERVILLE:

Q. Were those tests made under the regulations of 1883?

A. They were—was confronted with the results of our investigations, and given full opportunity to explain the cause of the discrepancy naturally thrown upon the laboratory, was unable to offer any explanation; in fact was greatly surprised at the showing of those tests and the tests continued to be made by the Secretary of the Treasury after our commission had finished its work in that direction. After the close of the investigation made by the commission, of which I was a member, the Secretary continued the investigations up to the time when the tariff act of 1883 was repealed by the passage of the tariff act of 1890, in the fall of that year. Then as sugar went into the free list no tests were made by the Government until the act of 1894. Under the act of 1894 no sugars were tested in the laboratories in order to determine the classification or rate of duty, but simply to arrive at their dutiable value, under that act those comparisons were not conducted, if I am not mistaken. At least if they were, the results of any comparisons I am not familiar with. But the discrepancy apparent at New York on the one hand, and the practical agreement at Philadelphia and Boston, on the other hand, continued until the time sugar went into the free list in 1890.

Q. Were the samples which were examined by the chemist at Philadelphia, were those the same samples that were examined here at the port of New York?

A. They were. On each day of the week the chemist, or the sugar examiner, not the chemist; he was not supposed to know where the sugar samples came from (the chemist); the sugar examiner at New York prepared a certain sample of sugar and divided it into three portions, being careful to mix it; he sent one portion into the laboratory in the regular course of business, and he
95 would examine it as a regular sample, and presumably it was tested by him in the same manner as the current samples of regular importations. One sample was sent to the laboratory and the other two parts sent by mail the same day to the chemists at Boston and Philadelphia, and tested there on the following day. The results were reported by the examiner to the department. And the same day the sugar examiner in Boston and Philadelphia each prepared a sample in triplicate, the three portions being identical and in the same manner, and one sent to the chemist at New York—examiner at New York and Boston, or Philadelphia and New York,

as the case may be, for test comparison. Whereas the sugar tested at New York to-day, we will say, was tested at Philadelphia and Boston tomorrow, and if there may have been, as is alleged, a slightly higher test in those two ports, that was in each case counterbalanced by the fact that the samples sent to New York and prepared in Boston and Philadelphia, were tested in those two ports the day before they were tested in New York. So far as any appreciable discrepancy between Boston and Philadelphia, as alleged, that was counterbalanced by the exchange of the three ports during that investigation.

I wish to say in regard to that testimony concerning the quartz plate, marked as was stated by Dr. Sherer, the main figures I have forgotten, but the decimal .1—2 same as be stated the quartz plate had not been in use in the Boston laboratory. It has been stated that that was the point of criticism and accounted for the difference between the Boston and New York tests, and that one chemist claimed that meant 92.5, and the other chemist that it meant 92 and 1/10. That quartz plate was withdrawn from the laboratory and sent to Europe and was, therefore, not in the Boston laboratory for any considerable part of the time those tests were made. That quartz plate did not account in any degree for the difference—for the discrepancy between the tests at New York and the other ports.

And furthermore, I am not aware, as was stated yesterday, and I do not recall that the difference was alleged to have been accounted for by the so-called standard flask in use at Boston. My recollection is indistinct as to that, but that cannot be true, as the tests at Boston and Philadelphia agreed substantially, and the so-called standard flask I know was not used in Philadelphia. It may have been used in Boston and still the tests averaged about 6/10 of a degree higher in each instance than the tests at New York. Those differences were not accounted for by either the use of the quartz plate, because it did not continue in use in Boston during the investigations, nor by the use of the standard flask, alleged to have been the cause, because the standard was not used in Philadelphia, where the tests were the same as in Boston.

The result of that investigation satisfied the Treasury Department and all concerned that correct results were not practicable with the then existing regulations, but when sugar went on the free list, no further concern in the testing of sugar and the regulations
96 affecting them was had until the tariff act of 1897 came into effect, that being the first time since 1890 when sugars paid duty according to the polariscopic test.

In conference with Assistant Secretary Howell and others and myself, it was thought, in view of the extraordinary and conceded difference between the New York laboratory on the one hand, and the other laboratories on the other hand, under the act of 1890, and, a difference which we believed must have existed long priod to the time the investigation was made, a difference which was explained, however, in a measure, by the experts of the Government, Mr. Tiltmann and Doctor Wiley were due partly to a difference of standardization, that I understood meant the quartz plates, flasks, tubes and

other apparatus used in the testing of sugars prescribed to be of suitable quality and character—that those differences were in part due to the standard in use at that time. For instance if the appraiser at Boston, if he wanted some additional flasks, tubes, and so forth, he would simply ask the department to authorize him to make the purchase and he would go to a glass dealer in those articles and buy them and take it for granted that they were perfectly standardized——

Q. Where are they purchased?

A. They are manufactured abroad. I think the flasks are made in this country and perhaps the tubes which have particularly a standard to give them length and column in sugar. They are made by manufacturers both abroad and in this country. And under existing regulations, to avoid that result in 1890, due, we were told, to the difference in standardization, in fact, there being no uniform standards, it was determined to have all the Government apparatus standardized by the highest—conceded to be the highest authority in the Government by law—authority on weights and measures, namely, the Coast and Geodetic Survey. And ever since that time, every flask, every tube, every polariscope and every quartz plate, every article requiring uniformity——

By General Appraiser WILKINSON:

Q. But in standardizing those instruments did they standardize within the old system?

A. No, under the new system——

Q. I mean in regard to the correction for temperature and things of that kind?

A. I was coming to that point. I am not able to say. I will leave that for Mr. Braid, who represents the office of the Coast and Geodetic Survey and he can fully explain. I would like to say this, however, that one of the results of the investigation made in 1890 by the commission, the result of their personal observations, was confirmed by the investigations made by Doctor Wiley and Mr. Tiltmann of the Coast and Geodetic Survey—that the difference in the tests—and there was no denying those differences at the time,
97 although Mr. Sherer's memory is not as good as mine at present—that the difference of 6/10 of a degree was due party to the difference in standards, and partly in the failure to observe the temperature. At that time the New York laboratory occupied the upper story of the building and formed a part of the appraiser's stores—the sugar laboratory was on the top and communicated with by floors below by means of open stairways, it was, therefore, the hottest place in the building. This matter presented itself to the commission in 1890 when they first visited that laboratory. And when I advised Doctor Wiley, and, if I am not mistaken, Mr. Tiltmann, they subsequently verified our observations in that respect, and found in part the difference of test were due to the different temperatures which were maintained in the different laboratories.

By Judge SOMERVILLE:

Q. What time of the year was that?

A. Our work commenced in the winter, I think perhaps early winter or the late fall of 1889 and continued until the summer in 1890, and our tests were kept up nearly all that time so that they covered both the cold and warm season of the year, and in fact were continued by the department until the fall, when sugar went onto the free list.

Those are the reasons why it was deemed advisable to remodel the then existing sugar regulations affecting the test of sugars; and in doing so, I will only say that I think that it is very important that the board should know that the old regulations have been taken as the material substantial basis for the new regulations and that the verbal changes are very few, and we now have substantially the old regulations with a very few verbal changes in fact.

I would like to add that it was the opinion of Assistant Secretary Howell and the Secretary himself——

Mr. TINGLE: I object to that.

WITNESS: I will put it another way: Another reason why the regulations were modified was this: It was deemed important that in the testing of sugars, which is regarded by the department as a highly chemical test, that the Government should avail itself of the latest improvements in science, and that if it failed to do so, the Government would be lacking in its duty and would be responsible for errors that would grow, in fact just such errors as was discovered in 1890, and which it was absolutely necessary should be corrected. The Constitution requires that duties shall be uniformly administered, and we found under the old regulations of 1890 there were too constant differences in the assessment of duties on sugars, amounting to—to 6/10 of a degree, and many thousand dollars in the aggregate. The regulations were therefore changed, or remodeled in part, to enable the Government to avail itself of the improvements of science.

98 By Mr. GIBSON:

Q. Have you any knowledge of the Treasury Department having in use regulations in regard to the testing of sugars by the polariscope method in regard to paying bounties to sugar producers, domestic sugar, under the act of 1890?

A. I have some knowledge of that fact although I was not personally connected in any way with the enforcement of that portion of the law, or the regulations thereunder.

By Judge SOMERVILLE:

Q. What system was used at that time?

A. The present system.

Q. Substantially the regulations of 1897?

A. The regulations of 1897 as remodeled under the act of 1883, with the modifications under the bounty provisional law of 1894.

Q. Were they ever published?

A. Oh, yes, the bounty regulations were published by the Internal Revenue Bureau in 1890-1891.

I have referred to the difference in the tests that we discovered under the law of 1890. When the law of 1897 became a law, Assistant Secretary Howell, at the suggestion of Chief Comstock, where such matters properly belong, requested me to have some supervision over the enforcement of the sugar schedule of the tariff law and these regulations were based and devised upon those that had preceded them, and there was a committee appointed composed of Doctor Wiley and his colleagues—other eminent scientists—to investigate the matter from a scientific point of view. And it will be found that there is also a provision in these regulations for the daily exchange of samples between the different laboratories for comparison of their work, as was instituted by the commission of which I was a member in 1890, and was so done by the department after that commission completed its work. Those reports of those tests of samples exchanged daily between the different laboratories come to my office and are compiled by me, and they show results of remarkably close agreement between the different laboratories, especially as compared with that which prevailed in 1890——

Q. That is under the regulations of 1897?

(WITNESS:) And the work of each of the three laboratories shows a harmonious agreement and shows that the conditions and the laws are carried out for the ascertainment of uniform duties, and the average difference in the tests of these comparative samples of sugars shows uniformity of work and an agreement by the chemists at the three ports within 1/10 of one per cent., a difference that is considered to be practically null in sugar chemistry in the use of the polariscope——

Q. Practically an agreement?

A. I believe so; yes, sir; and a difference that is less than 1/6 of the difference that prevailed in 1890. In other words, the
99 comparative tests show that the work in the three laboratories, so far as concordance under the regulations is concerned, is very satisfactory and is what the department has endeavored to accomplish.

By Mr. TINGLE:

Q. You spoke of the three ports, New York, Boston and Philadelphia, are those the three ports at which nearly all the sugar is imported?

A. Yes, sir.

Q. That is why these ports are spoken of?

A. Yes, sir.

Q. You find that there is a great- improvement in the uniformity and equanimity of the tests made under these present modifications of the regulations than there were under those of 1883?

A. I have so stated and so believe.

Q. During those investigations that you spoke of in 1890, in what condition were the samples that were sent to the different ports to be tested, in what condition were they?

A. They were sent at that time in practically the same manner as they are now sent, if I am not mistaken.

Q. Were they in the ordinary round tin boxes?

A. They were.

Q. Sent on different dates to the same chemists?

A. The sample prepared at New York was sent to the chemist for analysis to-day, we will say, under the regulations, under the practice that prevailed in 1890, were sent to the chemists at Boston and Philadelphia on the following day.

Q. Those were sent by him you stated?

A. They were——

By Judge SOMERVILLE:

Q. How were they packed?

A. In tin boxes, if I am not mistaken, made air-tight as near as possible by a band or oilcloth, perhaps mucilage paper around the cover.

By Mr. TINGLE:

Q. Having been sent by mail, those chemists knew where they came from?

A. No, sir.

Q. How is that?

A. They were delivered to the different appraising officers of sugar or examiners, and he transferred them to other small boxes and sent them into the laboratories as a part of the day's work.

By Judge SOMERVILLE:

Q. Did they have any instructions not to inform the chemists where they came from?

A. He had.

100 By Mr. TINGLE:

Q. They were transferred to other small boxes?

A. I presume so: they went into the laboratory without any distinguishing marks, simply a sample number affixed by the local examiner.

Q. They were transferred from one box to another: would not that affect the moisture in the sample?

A. I don't know, sir; I am not certain that they were so transferred.

Q. What number of samples were tested at Philadelphia and Boston as compared with the number tested at New York, alone?

A. Boston and Philadelphia. You refer to exchange samples?

Q. Yes.

A. The same number, one each day from each port.

Q. They received and sent one a day?

A. I think perhaps when our investigation was being conducted there was an exchange, perhaps a larger number. There was a daily exchange between the different ports.

By Judge SOMERVILLE:

Q. How many samples?
A. One sample each.
Q. One of each importation?
A. No, sir, one sample to-day, it might be low grade and to-morrow, high grade.

By Mr. TINGLE:

Q. What is the comparative difference in business done in sugar between the three ports?
A. I am not familiar with the figures, but the importations of sugar at New York are greatly in excess.
Q. Are there frequently at Philadelphia and Boston, days when there are no sugar importations to be examined?
A. I don't think it is the case in Philadelphia, in 1890 I can state as to that. The chemists were instructed to test these sugars in the precise manner and the same as current importations, and there is no reason to believe that the chemists ever varied from the proper methods of testing our samples.
Q. But supposing at the time these samples were received in Boston and Philadelphia there was no sugar—imported sugar in port for testing, would not these sample-s know that the samples sent in had come from New York?
A. The samplers didn't make the tests of the sugar.
Q. I am speaking of the examiner?
A. The chemist, if but one sample went into the Boston laboratory on a given date, yes, it may be presumed that the chemist would recognize that as an exchange sample.
Q. Who was the chemist of the testing?
101 A. Doctor Leary was one of them.
Q. Who was at Philadelphia?
A. Doctor Dickson, and I don't recall who was his assistant.
Q. Was not the chemist at Philadelphia formerly an assistant of Doctor Leary at Boston?
A. Not at that time; subsequently Mr. Glover, who is now in the Boston laboratory, was employed in Philadelphia.
Q. Mr. Chance, you know nothing about testing sugar, I believe?
A. I have no personal knowledge——
Q. Why do you offer your opinion as to the correctness of testing sugar here as a witness?
A. I have offered—I have stated the facts in relation to the results of these comparative tests, and the satisfaction of the Government therewith.
Q. You stated in your direct-examination that it was because of the dissatisfaction of the department with the present method that you organized a commission for the purpose of making regulations, did you not?
A. I have stated that on account of the very great discrepancies discovered in 1890, as between the three ports, the department decided, if practical, to avoid the recurrence of such conditions, in the

interest of uniformity; and that for that reason it was determined, if necessary to revise the then regulations.

Q. When were these regulations revised—when was the work begun?

A. When the matter was taken up, I consulted with Mr. Crampton, chemist of the Internal Revenue Bureau, and Doctor Wiley and Mr. Braid. It was decided that the regulations should embrace the improvements of science in chemistry, and modeled upon those that had prevailed under the act of 1883, and those in force under the Internal Revenue Bureau for the bounty provisional law, and I understand that the existing regulations are substantially those that were in force in connection with the payment of bounty on domestic sugars.

Q. These regulations were revised, you say, on account of the dissatisfaction of the department with the regulations that were in force?

A. As the result of our investigation——

Q. Who was dissatisfied? You say the dissatisfaction of the department, who constituted the department.

A. The department is abstract, a nonentity—I presume composed of the Secretary of the Treasury, and those officers in connection with the Secretary, Dr. Wiley and other members of the commission, and in this instance Assistant Secretary Howell, Mr. Comstock, the chief of the customs division and myself, were called in conference from time to time, and were in cordial agreement that in view of
the conditions which were discovered in 1890, an improved
102 method of polarizing sugars that would bring about harmony, if such a thing were possible, should be undertaken.

Q. Was there any investigation made to ascertain whether those conditions that you say were discovered in 1890, continued in 1897?

A. There was not, because it was found immediately after the passage of the tariff act of 1897—it was agreed to avoid these conditions and improvements, if necessary, should be made in the regulations.

Q. Have not the polarizations of sugar gone on during the tariff act of 1894?

A. Simply, as I understand it, for appraising sugars.

Q. Tests have been employed then?

A. Yes, probably employed, and there may have been, if I am not mistaken, there were comparative tests; but the result of those did not come to me, and I was not in the department, and had nothing to do with the administration of the laws. I have no knowledge to this day of the results of any such comparisons.

Q. Your action was based upon what happened in 1890?

A. Largely.

Q. You have no idea—can you state whether the tests that were made in 1890 were abandoned in 1897?

A. I do not know.

Q. Then the department's dissatisfaction runs back to 1890?

A. You might so state.

Q. Was Mr. Howell Assistant Secretary in 1890?

A. He was not.

Q. Was Mr. Comstock chief of the customs division at that time?
A. I think he was.

Judge SOMERVILLE: That would be immaterial.

Q. Mr. Chance, you stated in your testimony, I believe, that Prof. Tiltmann attributed the difference in tests to the different standards used, I think you said?
A. Partly to the difference in standards.
Q. Now, if the standards at all the ports are the same, could such differences be properly attributed to the standards?
A. If there were such differences I presume they could not, if there were no differences in the standards.
Q. In Boston, it has been in testimony here, that the true centimetre flask was used instead of the Mohr flask?
A. I don't know that that was the case, it was not the case in Philadelphia.
Q. How do you know that?
A. I have never been informed that it was the case. While I don't know to the contrary absolutely, I believe it was not in use in the Philadelphia laboratory.
Q. Do you know the difference between the standard flask and the cubic centimetre flask?
103 A. I am unable to give you a scientific definition. I understand there is a difference.
Q. Have you ever seen the flask used in the Philadelphia laboratory?
A. I have.
Q. Do you know from seeing those flasks what they are?
A. I do not. I do not know what particular kind of flask——
Q. You do not know what particular kind of flask was in use in Philadelphia, do you?
A. I do not know absolutely.
Q. Who were the eminent scientists you spoke of who drafted these regulations?
A. They are and were the trained experts of the Government; Doctor Wiley, chief chemist of the Agricultural Department, Prof. Braid, chief official of the U. S. Coast and Geodetic Survey and Doctor Crampton, chemist in the Bureau of the Internal Revenue Department.
Q. They were the sole authors of these regulations?
A. The regulations relating to the polarization or analysis of sugar. They were remodelled upon their advice.
Q. Was no practical polarizer or chemist, engaged in the polarization of sugars for customs purposes, called into the matter in any way?
A. The regulations were submitted, I think, to the chemists at the three ports, for criticism, before they were promulgated.
Q. Were any chemists of the ports called to Washington for the purposes of consultating about the regulations——

Mr. GIBSON: One moment; I don't see that that is pertinent.
Mr. TINGLE: I wish to show, your honor, that these gentlemen

were called to Washington and consulted on the subject of these new regulations; and that the practical men engaged in the testing of sugar at these ports, strongly criticised those regulations; and that there was no harmony between them and the scientists that the witness has spoken of in his testimony.

Judge SOMERVILLE: Your question has been objected to.

Q. Did these regulations (1897) have the cordial assent and approval of the practical polariscopists at the different ports to which they were sent for criticism?

Counsel for Government renews his objection.

Mr. TINGLE: But the witness has stated they were sent for criticism. I want to know the result of that criticism?

Judge SOMERVILLE: That is hearsay evidence. If you want that part stricken out we will have it done.

Mr. TINGLE: I will have it done.

Q. Then, if I understand you, Mr. Chance, the regulations as they at present exist, of October 27, 1897, in regard to the test of
104 sugar by the polariscope, are the result solely of the work of the three gentlemen you have named?

A. No, sir.

Q. Well——

A. I have not so stated.

Judge SOMERVILLE: That would not make any difference.

Mr. TINGLE: Except this: That the department under the advice of Mr. Chance called these gentlemen in and had to do with the making up of these regulations for testing sugar by the polariscope; but, failed to call anybody that was practically informed in the business.

Judge SOMERVILLE: It is competent for you to call anybody you want now to show any defects in the regulations, not to prove that some man was reported to have said they were defective, or did not approve of them.

(Mr. TINGLE:)

Q. You spoke of the graduation of the instruments being done all through by the Coast and Geodetic Survey or some other central body of authority. Do you know as a mater of fact that the chemists at the different ports buy instruments and use them without having them corrected and without correcting them themselves?

A. At—prior to last year I was not stationed at the Treasury Department, and have no absolute, definite knowledge as to the manner in which supplies were furnished to the laboratories. If I can be permitted to so state, it has been my understanding.

Q. I don't care for your understanding.

A. I know that there has been no uniform method of standardizing instruments and apparatus in use in the analysis of sugars prior to last year.

Q. Didn't you state in your testimony that the chemists were in the habit of buying flasks, tubes and other parts of the instrument for polarizing sugar, and used them without being graduated?

A. I did not so state. I stated that the local appraiser, the chief officer of those offices, when he wanted additional apparatus, flasks, tubes, or whatever he wanted, would ask authority of the Secretary to purchase and transfer those articles direct to his store from the importing houses where they were bought. What was done by the appraiser at New York——

Q. What did you state as to the graduation of the instrument?

A. That there was no graduation by one standard authority, there being no standards of instruments. It simply amounted to the fact that each chemist standardized for himself, according to his own sweet will.

Q. If the chemists thus standar-ized their own instrument at their "own sweet will," as you say, then did they have any standards by which to be regulated in doing that?

105 A. I don't know; I presume so.

Q. What standard?

A. I do not know. I do know that the standardization by one authority is very certain to be more uniform than when the standardization is made at different places by different officers for their own purposes.

Q. Would you regard a chemist competent to test sugars by the polariscope who was not sufficiently able to standardize his own instrument?

A. I am not competent to answer that question.

Objection by Government counsel to question.

Q. Do you know what standard was used at that time in the standardization of polariscopic apparatus?

A. I do not.

Mr. TINGLE: As this witness has testified that he don't know, I move that the whole matter be stricken out of the record; that is, all the testimony which Mr. Chance has given which relates to the standardization of the instrument and its parts used in the polariscope, as he knows nothing about the subject.

(WITNESS:) I beg to differ with the gentleman.

Motion denied.

Q. You spoke of the investigations of Doctor Tiltmann; do you know whether or not Doctor Tiltmann examined the New York laboratory and stated that its tests were more nearly accurate than those made at Philadelphia or Boston?

A. I do not.

Objected to.

Judge SOMERVILLE: That would not be competent.

Mr. TINGLE: That report of Doctor Tiltmann is in existence and on file, and I ask that it be put in evidence if it is here.

Mr. GIBSON: I object to that; I shall object to it.

Mr. TINGLE: I submit, your honor, that Mr. Chance brought Mr. Tiltmann into his testimony.

Judge SOMERVILLE: That is only incidental, though. That would not avail anything.

Mr. TINGLE: I suppose the report of Doctor Tiltmann is a public document.

Q. Mr. Chance, I understood you to say that there was only one sample each day sent from one port to another?

A. There was daily three samples one from each.

Q. Not a sample of each test that was made?

A. No, sir.

Q. Now, the object of sending those samples in each case was simply to test their uniformity, was it not in a general way?

A. Yes, sir.

106 Q. Now, with regard to the tariff act of 1890–94, the matter of duty upon sugars was a comparatively unimportant matter in those acts?

A. The polariscopic tests of sugar under the act of 1894 was of little moment to the Government especially when it was conceded that the dutiable value of the sugar depended not upon the Government test, but upon the settlement test, as was finally determined.

Q. It was an *ad valorem* duty.

A. It was, and being unnecessary in determining the dutiable value of the sugar, it was finally conceded that the best evidence on that subject was the settlement test, and the Government tests were simply made so far as it related to the test as a verification, and was not controlling in the classification of the sugar, as is now the case.

Q. In regard to the act of 1890, sugar was on the free list?

A. There has been no polariscopic tests of sugar since the act of 1883 until 1897——

By Judge SOMERVILLE:

Q. Except to carry out the paragraph 231 of the tariff, relating to bounty?

A. I am referring to the bounty under the internal revenue law.

By Mr. TINGLE:

Q. Mr. Chance, do you not know that the sugars that were imported at this port under the act of 1894, do you not know that the sugar was invariably tested at the laboratory?

A. I do.

Q. Under what regulations were they tested?

A. Under the regulations similar to those which prevailed under the act of 1883, and perhaps identical with them.

Q. Was not the value of the sugar based upon the polariscopic tests made by the appraiser or his officer?

A. The appraiser's value, as determined by the polariscope, in the main, was not based upon the polariscopic test of the sugars made by him, as I have just stated; but was based upon the settlement test, and the appraiser's test was simply collateral verification of the settlement tests.

Q. But, Mr. Chance, in that case the value found for appraisement depended on the test?

A. On the settlement test.

Q. And the appraiser's test combined?

A. No, sir.
Q. The settlement test alone?
A. I think so.

Mr. GIBSON: I ask that the two last questions be stricken out.
Judge SOMERVILLE: Let them stand.

107 HARVEY W. WILEY, called as a witness for the Government, having been duly sworn, testifies as follows:

By Mr. GIBSON:

Q. Will you please give your name, occupation and residence?
A. Harvey W. Wiley, chief chemist of the Department of Agriculture, Washington.
Q. Doctor, are you a chemist by profession?
A. Yes, sir.
Q. Will you please state what institutions of learning you have attended and what offices you have held in connection with that science?
A. I am a graduate of Harvard university where I took a special course in chemistry, I afterwards studied for one year in the university at Berlin, chemistry especially; and while there took a special course in the food laboratory under Doctor Huxler, who taught me the use of the polariscope. Since then I have been State chemist in Indiana. In 1883 I was appointed chief chemist in the Department of Agriculture at Washington. Both as State chemist of Indiana and as chief chemist of the Department of Agriculture I have been continuously brought into contact with sugar analysis. I have investigated all the different kinds of polariscopes which have been invented; and I have studied all the different kinds of methods of testing sugar by the polariscopes of different kinds, both from a chemical and scientific point of veiw.
Q. Are you a member of any society or scientific associations, if so, what ones?
A. I am a member of the American Society for the Advancement of Science in America, the American Chemical Society and the German Chemists' Society.
Q. Have you been a member of any congress—international congress—which discussed especially sugar analysis or the polarization of sugars?
A. I was a delegate from the Department of Agriculture to the second International Congress of Applied Chemistry that met in Paris in 1896. At that time an international committee was appointed on sugar analysis of which I am a member. I also attended a meeting of the same congress in Vienna last year, at which time there was a meeting of the international committee on unifying practices in sugar analysis, which I attended.
Q. Did you take part in the proceedings and discussions?
A. I presented at the congress a paper on the influence of temperature on the polarization of sugars in compensating polariscopes. This meeting was held in Vienna in July or August this present year. I would like to say, Mr. Chairman, that the second Congress

of Applied Chemistry which met in Paris in 1896 was composed of delegates from nearly all countries and a discussion of international questions relating to applied chemistry, including sugar analysis was had. A report was made on the desirability of inter-
108 national agreements in methods of sugar analysis and the convention voted that it was highly desirable. A committee was appointed to consider the subject—of which committee I am a member—and the first meeting was held in Hamburg in 1897. In 1888—July or August—the congress held its third session in Vienna, and I attended as a delegate as I have already stated. The paper which I have referred to was discussed from a purely scientific point of view upon the influence of temperature on sugar tests, and showed the great influence which said variations had upon the polarizations of different sugar solutions. This paper was based upon experiments at the Department of Agriculture which I myself have made. I have made altogether more than 1,200 polarizations in the investigations of the subject discussed in the paper, and at temperatures beginning at 4 degrees centigrade. This was secured by allowing the apparatus and all the materials to cool in the same part of the room and allowing them to stand for a great number of hours until all the parts had come to this standard temperature then making up a practically pure solution of sugar and polarized at that temperature in that room.

By Judge SOMERVILLE:

Q. What temperature in variation?

A. Four degrees to 32 degrees. I then secured a temperature by watching the weather and working at night, where I got a uniform temperature of ten degrees throughout the whole night without a variation of more than half of a degree, and I made a similar determination at ten degrees centigrade. Then I watched my opportunity and at night again secured a temperature of 15 degrees where I repeated all these operations at 15 degrees under the same conditions, having all the instruments and solutions at this standard temperature for hours before beginning. And then I secured a temperature of 20 degrees by day and repeated all these operations at 20 degrees. I then secured a temperature of 25 degrees and repeated all these operations at 25 degrees. I may say to the board that in each one of these polarizations I made over 50 polarizations at each standard temperature. I then secured——

Q. Different tests or readings?

A. Different—I mean readings, reading each polarization four times making 200 readings for each one. I then secured a temperature of 30 degrees by artificial heat, keeping the air in the room——

Q. You mean you took 50 solutions?

A. I made 50, reading each one four times. I say in round numbers practically that number. And I read each tube with four different kinds of light so I could eliminate any error due to any one kind of light. I then secured an artificial temperature of 30 degrees. That was done by warming the room and using electric fans so that the temperature would be constant throughout the entire room. It is well known that the more elevated portion of a room contains the

more heated air and that the cool air is found at the lower
109 part of the room. Then I repeated my operations at the temperature of 30 degrees. Then I made another experiment at 35 degrees——

Q. Speaking of Fahrenheit?

A. Centigrade always. No other degree is used in scientific investigations in this country. I then made an artificial heat at 35 degrees. And then by artificial heat I obtained a temperature of 40 degrees, and instituted another series of tests, which is very high temperature, above 100 degrees Fahrenheit and this is as high as the work can be done with any comfort, in fact that is a Turkish bath for five or six hours together. I have here the results of these operations which I wish to offer in evidence as a part of this exhibit.

Paper produced by witness is marked in evidence Exhibit 1, 34769–F, December 16, 1898.

Now, Mr. Chairman, and members of the board, I will state that the instrument which I used is much more delicate than those in ordinary use. Doctor Weichmann has seen the instrument, and understands what I mean. It was made especially to order for the Department of Agriculture by Schmidt & Haensch, the celebrated makers in Berlin. This instrument was standardized by the usual method, using the Mohr flask and at 17.5 degrees of temperature and taking 26.048 grams of sugar weighed out in air with brass weights, so it corresponds exactly with the instrument used by the trade, except it is finer than used in the trade, made by the same manufacturers that make theirs, and graduated the same way precisely. I wish to impress that point that I used the so-called trade method, not the Government method, using strictly a Mohr flask and under the conditions mentioned. This instrument permits of much finer reading than in trade instruments in use and with successive readings rarely varies more than the tenth of a degree; while as a rule successive readings will not vary more than five hundredths of a degree in the reading. This occurs largely by having a triple field which makes the possibility of reading very much more accurate. I found that a sugar polarizing 100 degrees—I may say here that I did not use that sugar, but used one polarizing 99.96, which I call practically pure sugar—the sugar polarizing 1.00 at 17.5 C., polarized under trade conditions, that is, with the same instrument and the same flask as used in the trade, at 4 degrees C. 100.43 degrees. The polarization is raised from passing from 15.2 to 4 degrees by .43 of a degree, and that same sugar read at 40 degrees C. polarizing 99.29 degrees a difference of over one degree in the polarization of the same sugar with the trade instrument in passing from 40 degrees to 4 degrees, a variation of 36 degrees.

I wish to offer the data which I have obtained in these rigid investigations with the highest standard and finest instruments and the methods already acknowledged as correct by the trade, covering
a long period of time, in evidence. I wish here to state that
110 the paper which I read before the congress at Vienna was by vote unanimously referred to the international committee on sugar standardizations for their consideration and is now officially before that committee. I would like to offer the whole paper in evi-

dence, but I do not have it here; but the experiments developed on which these figures were based (referring to Exhibit 1) I will offer as a part of that exhibit.

Q. The conclusions reached in this paper that you spoke of are in your judgment correct, or have you any reason to change them? I mean the paper read before the International Congress?

A. I am ready Mr. Chairman, to demonstrate that before this board. In my opinion, these data are as correct as can be done under the conditions which existed and prescribed at the time of the investigation, unless instruments can be made finer than mine.

Q. I refer to the conclusions which you reached in your paper.

A. The conclusion which is based on this paper is showing that the variation——

Objected to.

By Mr. GIBSON:

Q. It was testified to yesterday, as I understood, from Doctor Weichmann and others, that the temperature didn't make any difference, provided the polariscope and the solutions were made up at the same temperature. Will you state whether or not from your experience and knowledge, that is a fact.

A. In each case, the solutions were made up exactly at the temperature at which it was polarized and that is a matter which was determined by a thermometer, standardized and certified to as correct by the office of weights and measures of the Coast and Geodetic Survey, and the statements in the paper are exactly contrary to those made yesterday, on the same subject.

Q. Doctor, will you state what connection you have had with the sugar polarizations at the ports of this country?

A. I have had no official connection with those polarizations. In 1890, I think it was, I don't remember the date exactly, 1890 or 1891, I was requested by the Secretary of the Treasury to visit the ports at Boston, Philadelphia and New York. I did so, using the best instruments which we had then in use in the Department of Agriculture, and using strictly Mohr flasks and polarizing strictly according to the methods then in use under the regulations of 1883; except I did not use a color instrument, but a shadow instrument. The solutions were made in the same way, clarified in the same way, in the same size flask and treated in the same way. I made many hundreds of polarizations at the ports mentioned, and I found a variation in the ports of between 5/10 and 6/10 of one per cent. degree in the various polarizations and by these comparisons.

111 By Judge SOMERVILLE:

Q. Were these tests made under the regulations of 1883?

A. Strictly using my own apparatus and conducting the examinations exactly in harmony with the regulations of 1883 in each case.

Q. Are you familiar with the methods of polarizing sugars used by commercial houses—please state them?

A. Yes sir; the method was so well stated by Dr. Weichmann

and met my entire approval. I will let his statement stand as mine.

Q. Will you state in what particular, if any, they differ from the method pursued by the Government at the present time by the present regulations?

A. Both methods of polarization reach identically the same result when correctly performed. The method of polarization if performed at 17.5 C., at which temperature it was meant, will reach the same result in either case. The Government instruments now employed are standardized for any temperature which may happen to obtain, therefore, they necessarily give correct results, whether it be at 17.5 or 40 degrees C.

Q. Do you eliminate the question of temperature?

A. Absolutely, because the instrument is standardized for every temperature. That is for every temperature which may happen to come in a laboratory, I believe from ten degrees to 35 degrees, in point of fact.

By General Appraiser WILKINSON:

Q. Doctor, how is it about the statement that the instrument being made for one kind of flask and you have applied another kind of flask for use with the instrument?

A. The size of the flask has nothing to do with it if you make the necessary correction. I can polarize in a flask which has 6.97 cubic centimetres.

Q. Why did you change from the one which was intended by the makers of the instrument?

A. If you will allow me, I didn't change it. That will be answered by Mr. Braid. The use of the flask which is not strictly the flask recommended by the makers permits just as accurate work, provided the correction is made in the polarization. In point of fact, the flask which is used by the Government holds .16 cubic centimetres less than the flask in common use, or the Mohr flask; therefore, unless a correction was made, the polarization would be .16 to- high. All instruments in our laboratories are controlled by quartz plates. If you use a flask which holds too little the sugar solution is stronger, therefore the polarization will be higher.

—. ——?

A. All polariscopes are checked or used in connection with quartz plates because the quartz plate is more convenient and because
112 its polarization is invariable, in common temperatures it will read the same. Its use is to establish the adjustment of the instrument before the sugar solution is read. Therefore the trade, and everybody else uses quartz plates in checking their instruments. In the use of quartz plates with our instruments, we throw away absolutely the mark on the plate and restandardize the plate for each temperature. Therefore, in restandardizing, we introduce that correction of .16 degrees, which is constant for every degree, and hence, when the solution is made up in a similar flask a correction is allowed in the table corresponding with the temperature. The flasks are graduated to contain 100.06 true cubic centimetres, the excess .06 being the correction for excess of sugar due to weighing the sugar

in air as against brass weights. Therefore, the correction is made at once and requires no more time of the observer to make the polarization than it does by the old method, absolutely the same.

By General Appraiser WILKINSON:

Q. You don't know why the change was made?
A. I do. The reason is—I didn't make it——

By Mr. GIBSON:

Q. State it?
A. The reason is this: The Mohr flask as standardized has been an artificial standard. It was therefore voted by the second International Congress of Applied Chemistry, which met in Paris in 1896—and this congress was composed of delegates from almost all countries, and discussed international questions on applied chemistry, the subject of sugar analysis among others—and it was thought advisable for all nations to adopt the true cubic centimetre flask as the standard—and it was voted at the congress or meeting of the international commission in Vienna to adhere to the Paris declaration, and that it was best for all countries to use the true cubic centimetre flask. Therefore, the Coast and Geodetic Survey, which is strictly a scientific body—the highest known in this country, and as high as that of any other country, therefore, when called upon by the Secretary for consultation, I believe, in regard to the formulation of the method of ascertaining the bounty to be paid on the domestic sugar, and as the test was considered a strictly scientific test, could not consider the Mohr flask as a standard. Therefore, they adopted a flask for absolute weight which would permit the sugar to be weighed in the air, thus avoiding the correction for the air weight.

By Mr. GIBSON:

Q. What is the relative agreement between polarizations at the different ports now, as compared with eight years ago, under the regulations of 1883, if you know?

113 A. I have seen all or nearly all the recent comparisons, which have been shown me by Mr. Chance, and I am familiar with the disagreement of several years ago. Several years ago there was a constant difference between the tests of sugars as performed in the laboratories at Boston, New York and Philadelphia, amounting to as much as five to six-tenths per cent. At the present time the agreement is extremely exact, rarely amounting to more than 1/10 of a degree.

Q. What personal knowledge have you of the correctness of the tests that are now made at the ports?

A. I have, as a member of the commission appointed by the Secretary to formulate the regulations which are now in use, visited the three ports mentioned in connection with Doctor Crampton and Doctor Braid, and made various polarizations unknown to the chemists at the various ports. We found that they agreed with our determinations very closely, and rarely varying—and the variations I believe in no case amounted to more than .15 from the determina-

tion secured by the commission. So that the agreement is extremely close in regard to these tests. I will say to the board that we made our tests by both methods, using the Mohr flask and trade method, also the Government method. In all cases our tests were identical when made by the two.

Q. What occurred—was there any conference with the trade chemists during that time, and if so, state what occurred?

A. Under instructions from the Secretary of the Treasury we asked the chemists employed in the trade to meet us in friendly conference to criticise our methods and point out any errors which they might find in them; we had a number of friendly conferences at each port, and it was stated that by the introduction of a different flask a necessary error was introduced in the polarization. When we showed the trade chemists that that was corrected by the quartz plate, I believe there was no objection. I remember particularly that Doctor Weichmann stated that that was not a valid objection. One gentleman stated that by our method pure water would polarize 100. Of course he was soon convinced of the absurdity of the statement and withdrew it. At that time there seemed to be no objection for allowing the correction in temperature. Several chemists who had made objections to the proposed system, when their attention had been called to the practical results of my work, seemed to be of the opinion that that settled the matter; and that temperature did have a very great influence on the polarizations. They seemed satisfied with the explanations which we made, and the objections, which they had supposed to be tangible, were reconsidered after our explanation of the matter——

Mr. TINGLE: I object on the ground that it is immaterial and hearsay.

Judge SOMERVILLE: You might have objected to the question, Mr. Tingle.

114 (Mr. GIBSON:)

Q. Will you state if any chemist who testified yesterday on the part of the protestants was present at these interviews you have named?

A. Yes, sir; Doctor Weichmann was and Mr. Wolfbauer was present, Doctor Sherer——

Q. Which Mr. Sherer?

A. This one sitting here now——

Q. Mr. John Sherer?

A. Yes, I don't know their names apart. I don't know which is Edward and which is John; they were present at these conferences.

Q. Will you please state what influence temperature has on the polarization of sugars in the instruments in common use? In proportion to the temperature, whenever below 17.5 or above?

A. Whenever the temperature is below 17.5——

By General Appraiser WILKINSON:

Q. You spoke about the uniformity under these new regulations;

one examiner has testified that about 30% of the polarizations of refined sugars have been over 100% which is apparently manifestly wrong polarization; how do you account for that?

A. Under the regulations of 1883 an allowance of 3/10 was permitted between readings as admissible; and the new regulations, which are only a modification of the old, continued this allowance. This allowance is permitted because the polarizations of sugar in the appraiser's laboratory is not a scientific operation—it is not performed with absolute accuracy. Such a variation would not be permitted in scientific determinations; but it is permitted in commercial operations. Therefore, in view of the forces which introduce error in commercial operations, the old regulations and the new regulations permit of a variation——

Q. Taking 100 polarizations, of these 100 there are 30% of that number evidently wrong; that don't show what percentage of the 70 may be wrong; but 30% that are manifestly wrong, isn't that a very remarkable showing?

A. I was just coming to that, in our experience, and we have shown that these variations do occur. It is plain to be seen that a sugar which polarizes 99.9 may be read by the chemists 100.2 within the limits permitted. If you have a still finer sugar, it is possible that the reading, under the regulations, both the new and the old, may be read 100.3 without being anything remarkable at all; or it might be read 99.7. These variations have been permitted, due to the necessities and unavoidable difficulties which are tendant upon the polarization of sugars from a commercial point of view. During the pendency of the present tariff act, the importers of this country, imported for the year ending June 30, 1897, an immense quantity of beet sugar, anticipating the adoption of the new
115 tariff,—bringing in immense cargoes which were not then used. These sugars were of all kinds, much of it was made from beet molasses and carried large quantities of *raffinose* which is regarded as pure white crystallization and that sugar will polarize much higher than cane sugars. All refined sugars are made from that, traces of raffinose entering the refined article and increase the polarization, so I would not be surprised at all, even with the most scientific care, to find a sugar which would polarize 100.5 when made from sugars of this character——

Q. If they are high grade sugars that are expected what are the reasons for the allowance of 3/10?

A. In customs operations, it is not possible to introduce the refinement of adjustment into the polarization, compared with a scientific point of view, therefore variation between two observers is permitted, in the end to secure practical uniformity of result, and it has been permitted by the regulations from the start.

By Judge SOMERVILLE:

Q. That is allowable to avoid possible error?

A. Unavoidable error, for the kind of work done, Mr. Chairman.

Q. Are you familiar with the method adopted by the Government

in testing sugars under the tariff act of 1890 relative to the bounty paragraph 231?

A. I believe I was chairman of a commission that fixed those regulations.

Q. What regulations did they correspond with; with the regulations of 1897, to which reference has been made, or those of 1883-94?

A. They are very much like the regulations of 1897; in fact the present regulations are a modification of the regulations of 1891, as those were a modification of the regulations of 1883.

Q. I hand you a book or pamphlet entitled "Regulations Relative to the Bounty on Sugar, United States Internal Revenue, Series 7, No. 17, Revised," purported to be printed by the Government, August 18, 1892; please examine page 47, which is headed, "Instructions relative to the use of the polariscope in testing sugar upon which a bounty is to be claimed," and see if those are the regulations under which these tests were made in regard to carrying out the bounty provisions of *1990*.

A. (Document referred to handed to witness.) From reading the very first line, I would recognize those as the regulations in question, as of 1891.

The document referred to is offered in evidence by counsel for the Government, and it is admitted and marked in evidence Exhibit 2, 34769-F, December 16, 1898.

116 By Mr. GIBSON:

Q. What comparative tests were made by the New York chemists last summer—1898, and what do they show?

A. During the period at which the commission which I have just spoken was making their tests, we deemed it advisable to send the same samples to a number of trade chemists in order to get their polarizations by their method on these same samples—some 25 or 26 in number I believe——

Q. Have you a paper showing those?

A. I have a paper showing the results, yes, of these comparative determinations between the trade chemists.

Q. Is that the paper? (Paper produced by witness.)

A. This is the paper, sir; this paper shows the polarizations obtained by the trade chemists on samples prepared by the appraiser of the port, and taken from the same quantity package as the samples furnished the commission was taken. These samples were, therefore, as nearly identical as can be made and were all forwarded at the same time to the three chemists who were employed by the Secretary of the Treasury for doing this work, they not knowing that they were samples under consideration by the commission. One test was made by Sherer Brothers, another by G. Grund and another by A. Weichert. These numbers are identified by serial numbers and the numbers will be sworn to by the appraiser here that they are the same as indicated. This shows the variations in polarization as conducted in the trade on the same sample, as compared with the slight variations if the Government regulations are

followed. Sherer Brothers have an average polarization of the 25 samples tested of 92.15; G. Grund has an average polarization of 92.39; and A. Weichert has an average polarization of 91.98, a maximum difference of .4 per cent. in individual cases; the greatest maximum difference was in regard to samples 9380; Sherer Brothers polarized that number 97.40; G. Grund, 86.80 and A. Weichert, 86.40, a maximum difference of 1.00.

By Judge SOMERVILLE:

Q. Under what regulations were those tests made by these parties?

A. By their own methods of polarization. I don't know what, they followed their own.

Q. Was it the so-called commercial method or——

A. It is presumable that they were.

The paper last referred to and produced by witness is marked in evidence Exhibit 3, 34769-F, December 16, 1898.

At 1 o'clock the board took a recess until 2 p. m.

117 DECEMBER 16, 1898—2 o'clock p. m.

Hearing resumed.

Present: Same as before.

Testimony of HARVEY W. WILEY continued.

By Mr. GIBSON:

Q. Doctor, will you please state what the purpose of having these tests made by these gentlemen was?

A. You refer to the tests made by the trade chemists?

Q. Yes.

A. Through their employment by the Secretary of the Treasury, we desired to show, Mr. Chairman, that the so-called trade method which was stated to be the only method, was full of errors, even in the hands of its friends; that was the object of sending these samples out.

Q. Doctor, what influence, if any, has the volume of the flask on polarization?

A. None whatever if you know the volume and you make the calculations accordingly.

Q. I would call your attention to the flasks that you have there and please explain——

A. I don't know which these are (referring to two flasks on desk).

Q. Is one centigrade?

A. This is the centigrade, this small one; this short one is the Government flask and I will state to the board is slightly smaller than this one (indicating).

By Judge SOMERVILLE:

Q. Is that one, the shorter one, used under the regulations of 1897?

A. Yes, sir.

Q. Will you please tell us what the Mohr flask is and what the cubic centimetre flask is?

A. The Mohr flask is the longer one and holds 100 grammes of pure distilled water when filled up to this mark (indicating) at a temperature of 17.5 C.

Q. Only one mark on it?

A. Yes; the true cubic centimetre flask holds exactly 100 grammes of water at 4 degrees C. of air weights, reduced to vacuo; that is, absolute mass, which is a true cubic centimetre standard.

By Mr. GIBSON:

Q. Do you know which one of those flasks is now in use in France, Belgium or Holland?

A. I have been in a great many laboratories in France, but not in Belgium. Throughout France they use the true cubic centimetre flask as the one that is in use in commerce and in science almost exclusively.

118 Q. Is that the same that is used by the Government?

A. It differs from the true flask by a quantity of .06 cubic centimetres. The Government flask is drawn true by that quantity.

Q. Why is that, Doctor?

A. To avoid the reduction to vacuo of the sugar weight, so as to make the correction in the flask to avoid the troublesome calculation which would have to be performed by the observer; the flasks differ only in allowing for the weight of air displacement in the weighing of the sugar.

By Judge SOMERVILLE:

Q. That leads to accuracy instead of error?

A. Yes, sir.

By Mr. GIBSON:

Q. What is the quartz plate as used in connection with the polariscope?

A. A quartz plate is natural quartz and their use in the polariscope is to rotate the plane of polarized light to the right or to the left and are possessed with the same power of twisting the polarized plane of light that the sugar solution has——

By Judge SOMERVILLE:

Q. Are they in the shape of a prism?

A. Usually of a disk, but the shape—it may be square, or may be a disk—it is usually round; but it is often a square. Its outside has nothing to do with it, it has the same power of polarization either to the right or to the left. The quartz plate is used because its polarization is constant and to ascertain the correct adjustment of the instrument; the rotation, however, varies with the temperature.

Q. Could any quartz plate be used accurately with the flasks in common use?

A. Yes, sir; any quartz plate can be used with any flask, or any polariscope, provided it has a value given to correspond to the size of the flask and to the scale of the polariscope.

Q. How is the value ascertained?

A. In the first place, we will ascertain its value by comparing it with a polarization of chemically pure sugar, a sugar which is known to be chemically pure, and that is called the sugar value of the quartz plate. The specific rotatory is entirely different, however, from determining its value, and is done in a different way.

By Mr. GIBSON:

Q. Now, what are the quartz wedges, what are their purpose in polarization?

A. Quartz wedges are two pieces of quartz, each cut in the shape of a wedge, and when they are superimposed they form a quartz plate—their sides are parallel. When the two are put together
119 the effect is the same as the quartz plate. The thickness can be varied at will, either you can make it very thin or very thick, as the circumstances may require. Their plane of rotation is opposite to that of the sugar solution and by varying the thickness of the wedge a normal polarized light is restored.

Q. Has the temperature any influence on the quartz plate?

A. The temperature has a very decided influence on the polarization of a quartz plate, the polarization rising as the temperature rises and the polarization falls as the temperature falls.

Q. Has it any on the wedges?

A. Has naturally the same effect upon the wedges that it has upon the quartz plates. When the temperature of the wedges rises, their rotation for a given thickness increases on account of the temperature, and when the temperature falls, the rotation for a given thickness decreases.

Q. You remember the testimony of one of the witnesses in regard to the wedges, one of them only, he stated moved, and the other was stationary and that the variation was compensated for by the wedges; will you please explain what difference there is in the wedges and whether both wedges move, or only one?

A. Only one wedge is movable because that is all that is necessary to secure the same thickness; one way the thickness is increased as the wedge moves upon the other, and the thickness is diminished when moved the other way.

Q. Will you please state whether or not the method of using the quartz plates in the Government laboratories is accurate or not?

A. The method in use is absolutely correct, so far as it can be secured by ordinary human ingenuity.

Q. What influence, Doctor, would the admixture of refined sugar with very low grade goods have on the polarization?

A. It would depend largely upon the nature of the low grade; if it were beet molasses, or low grade beet sugar, there would be a tendency to the introduction of raffinose into the sugar which has been known to affect the polarity of the sugar. Cane sugars also may contain raffinose but not in very large quantities.

Q. Will you please state whether or not pure sugar could polarize over 100.

A. A pure sugar accurately measured and correctly polarized

could not polarize over 100 degrees. I may add that an observer may polarize a given solution 100.2 which would have been polarized under normal conditions at exactly 100 by another observer.

Q. Is there also an allowance for inaccuracies for the observer in these regulations of .3?

A. I wish to correct my former statement; I said that the present regulations had the same variations as the former ones, that is, .3. With these present regulations we do not need as great a variation, because we think that our system is more accurate, therefore a less variation is permissible than .3; and the new working regulations permit only .2 in ordinary commercial work; therefore, a practically pure sugar may be read to polarize 100.2 without exciting any comment whatever; that is within the prevailing permissible variation allowed by the regulations and under the old regulations they could be read 100.3.

120

Q. The average reading probably would be what?

A. The average would be 100 or below. The average polarizations are below 100 with sugars tested by the present method.

Q. Will you please state, if you know, what was the influence of temperature upon the operations or tests of sugar you made?

A. The temperature works in a great many ways, varies with the size of the flask or contents of the flask—varies with the temperature. If the flask is graduated to hold 100 cubic centimetres at 17.5 it will hold less than 100 cubic centimetres at a temperature of 10 C. say and the first effect may be said to be in the flask itself. In the second place, it affects the length of the observers' tube; that tube is measured at a given temperature, therefore, if it is used at a higher temperature, the tube will be affected, the column of liquor will be longer——

By Judge SOMERVILLE:

Q. What is the temperature?

A. 17.5—and the third way is in the variation in the value of the quartz wedges which are used for measuring the degree of rotation, as was brought out yesterday. Thus we speak about the variation in rotation at different temperatures. If you use a wedge at low temperature it takes a less thickness of it to produce the same effect than if you use it at a higher temperature, therefore it requires a less thickness of the wedges to polarize the rotation than it does at low temperature, therefore, you move your wedge less, therefore, the reading is less. That is the third reason of the influence of temperature on sugar polarizations. The fourth is the specific rotatory power. In the case of sugars and other optically active bodies, the standard of comparison is called the specific rotatory power of the sugar molecule, which depends to a certain extent upon its temperature. As the temperature rises, the power of the sugar rotatory plane decreases, therefore, the sugar polarizes less at a higher temperature. These are the four principal causes of the effect of temperature upon polarizations of sugar.

Q. Doctor Weichmann referred to your book and cited a paragraph in which you stated that temperature had very little influ-

ence upon the results of polarizations of sugar. Will you please state whether that was a correct statement?

A. It was correct at the time that that was written, which is about a paragraph five or six years ago. The book has not been published as long as that. At that time I consulted all the authorities on this subject, such as Landow and Lipmann and Cowne and Andrews, the latter in this country. Landow and Lipmann were of
121 the opinion that temperature, while affecting the rotatory power of sugar, did not affect it with sufficient magnitude to render it of practical value in polarizations. In this country, Andrews, of the Institute of Technology at Boston was rather of a contrary opinion, so in weighing those authorities I gave weight to the greater number of witnesses, and thus held in my opinion. At that time I had not investigated the subject myself from that point of view.

By Judge SOMERVILLE:

Q. Your conclusions which you have referred to in your testimony were reached since that time?

A. Even since this book was published (referring to "Principles and Practice of Agricultural Analysis, vol. III, Agricultural Products—Wiley," p. 117, paragraph 103) and then in regard to the rotary influence on the quartz wedge, I desire to introduce a paragraph from my book, simply to substantiate what I have said. It is short, only four, five lines, I will read it (page 97, 10th line, read by witness as follows):

"Temperature affects the rotating power of a quartz plate in a degree highly significant from a scientific point of view and not wholly negligible for practical purposes."

By Mr. GIBSON:

Q. Doctor, will you state whether or not your experience and observations since writing that article have undergone any change?

A. I will answer that question in a moment. This paragraph here has nothing to do with the subject that Doctor Weichmann quoted. The rotary power of a quartz plate is affected by the temperature.

Q. Has your experience in regard to the temperature undergone any change on that subject since you wrote the paragraph read by Doctor Weichmann yesterday?

A. Yes, sir; it has. My conviction has undergone a change, due to my own researches.

Q. Did you find that the temperature affects the polarization, and to some considerable extent the accuracy of the polarization?

A. The specific rotatory power of the sugar—I find on further examination that the temperature does affect in a very appreciable way the specific rotatory power of sugar, therefore that factor cannot be neglected.

Q. Do you know whether or not these private chemists took into consideration any allowance for temperature in testing? Or have you any knowledge on that subject?

A. Yes, I have knowledge of absolutely what they said and I never found one who made any correction for temperature. One party will testify that he has—he does make such allowance, but I have no knowledge of it myself.

122 By Mr. TINGLE:

Q. Doctor, you stated a moment ago that the change in your views as to the effect of temperature in polarizations was of recent date, since your book was published in January, 1897?

A. Yes, sir; I did.

Q. You also stated, I believe, that the prior regulations for the polarization of sugar, under the act of 1890, were a reprint of the bounty regulations?

A. Yes, sir.

Q. How did it happen that you introduced into those regulations the same provisions, practically, as to the effect of temperature in rotatory power?

A. Because those regulations were based upon actual determinations of polarizations against pure sugar solutions. I was then, as I am now, fully convinced of the greater effect of temperature upon quartz wedges. At the time those regulations were made I was of the opinion that there was a variation due to the temperature of the wedge as affecting the rotatory power. I have also changed my view in regard to the importance of the latter, though I still hold to it as I did then.

Q. How great an influence do you ascribe, or did you ascribe at that time to the influence of temperature on the quartz wedge?

A. I ascribed—it was my opinion that almost all the variation, that is a large portion of it, was due to the action of the quartz wedge and only a smaller part due to other causes.

Q. How much variation was that?

A. The variation was found by Professor Andrews—.027 for each degree of temperature centigrade and found by the office of the Coast and Geodetic Survey .029 for each degree.

Q. Are you personally familiar with Prof. Andrews' work on that subject?

A. I have read his paper.

Q. Can you identify it if I hand it to you, Doctor?

A. I think perhaps I might.

Q. This is the Technology Quarterly of 1888-'9, vol. 2, published by the Institute of Technology, Boston, page 367, an article on the influence of temperature on the specific rotation of cane sugar; is that the article to which you referred as the author of your statement?

A. (Book handed to witness.) Without reading it, I should say it is. There are two of them here, however—I think that is the paper. I will state that my convictions at that time are based chiefly on the work of the Coast and Geodetic Survey made in Washington. Those are the two papers that I referred to.

Mr. TINGLE: I ask that the last part of the answer just made be

stricken out as it is not responsive to any question—the last part.

Last question and answer read.

Government counsel objects to motion of protestants' counsel.

123 Motion to strike out last part of witness' answer allowed.

Q. I call your attention to the formula on page 371; are you aware or do you know that that formula is correct?

A. No, sir; I don't.

Q. Do you know it is wrong?

A. I do not.

Mr. TINGLE: I would ask the board that permission be given Doctor Weichmann to put a scientific question which I don't quite understand myself? And he can put it better than I can.

Mr. GIBSON: He might write it down.

Judge SOMERVILLE: We will allow the question to be put as if by counsel.

Q. As the formula to which your attention has just been directed in Doctor Andrews' paper is virtually the summing up of his experiments and investigations, and an expressed conclusion which he has reached; will you take this formula and translate it into sugar degree values and tell us what it is and what this difference amounts to, as you have stated and given Doctor Andrews as the authority that the difference amounts to .27 degrees?

Q. The question misrepresents me; I said .027.

(Mr. TINGLE:)

Q. Will you take this formula and tell us what it means or what it amounts to in sugar degrees?

A. I will not.

Q. Why not?

A. Because I have not studied the formula.

Q. You cited this article?

A. I wish to state to the board that I read this article many years ago. I do not propose to get up here and discuss Mr. Andrews' paper before this board.

Q. You say he is an authority, if I am not mistaken, and did you not also state that your conclusions were based partly on the paper of Doctor Andrews?

A. I did.

Q. Yet you decline to tell the board what that formula, which is an epitome of the whole matter, means?

A. I don't object to telling the board in general what it means. It means that temperature has an influence on the specific rotatory power of sugar. That is what it means.

Q. What is the meaning of that formula?

A. It is right there.

Q. What does it amount to, translated?

A. I am not here to interpret Mr. Andrews' paper.

Mr. TINGLE: If your honor please, the witness has stated that he

based his conclusions partly on the statements of Prof. An-
124 drews; now, when we ask him to explain what those conclu-
sions of Prof. Andrews were, the witness seems to be unable to do so.

Judge SOMERVILLE: You are calling upon the witness to interpret a paper he did not write. He has stated in his judgment it was wrong——

WITNESS: No, no; that the formula was wrong? Not at all. I judge that this conclusion is a just and correct summary of the data which he had. That conclusion shows that the temperature does affect the specific rotatory power of sugar, as he says himself. I am not called upon to explain his paper; I will explain my own.

Mr. GIBSON: I would suggest to the board that the proper way to get at this would be to offer the book referred to in evidence.

(Mr. TINGLE:)

Q. If this particular paper to which you have reference in your calculations in 1890 on this subject of temperature were based in whole or in part upon Prof. Andrews' paper to which we refer here, and Prof. Andrews' paper is shown to be wrong in its calculations, would your conclusions then undergo any change?

A. Do you ask if I am an honest man?

Judge SOMERVILLE: He don't mean that, Doctor.

(Mr. TINGLE:)

Q. You have your book there Doctor, will you kindly turn to page 105, line 27, from the top of the page; please read that sentence?

A. (Reading from book hereinbefore mentioned vol. 111, agricultural products—Wiley.) "The influence of temperature on the rotating power of other sugars, is not imperceptible in all cases, but in practice is negligible." That is as stated above is——

Q. What "other sugars" did you mean?

A. I mean levulose, dextrose, ratlinose or any other sugars; the only exception I make there is levulose.

Q. Isn't that applicable to sucrose?

A. The statement was applicable at that time; I thought it was negligible.

Q. At the time that book was written. Do you still hold that that influence would be negligible in ordinary polarizations?

A. This part was written many years before it was published. It was not written in 1897.

Q. Published in 1897?

A. Published on the first of January.

Q. Were you aware that it contained those errors?

A. I didn't consider them errors at the time. I have already stated so. Since then I have been convinced that they are.

Q. At that time, January 1, 1897, you still held those views?

125 A. At that time, as I have stated that, while the influence of temperature on the rotating power was not imperceptible, yet

it was negligible. This is particularly on the rotating power, not on the quartz plate.

Q. In 1890, however, prior to the regulations of 1890 for the bounty provisional law, you held a different view?

A. I said I took into consideration Mr. Andrews and did not give it as much weight as I do now.

Q. If we could convince you, Doctor, Andrews' paper was wrong, its conclusions were wrong, would you concede then that your views were wrong?

Question excluded, not competent.

WITNESS: I have answered that all my views are based upon my own investigations, not upon Andrews'.

Q. You gave Andrews as one of your authorities?

Judge SOMERVILLE: That would not be competent. I propose to rule that out.

Q. You spoke of the different flasks used in the different countries and that they would have no effect if a different weight was employed where a different flask is used?

A. What do you mean by different weight?

Q. Different normal weight.

A. Of what?

Q. To correspond to the flask that is used?

A. The weight has nothing to do with the flask that is used.

Q. Nothing whatever?

A. Nothing whatever. If you know the volume of the flask,—amount of sugar, you don't need——

Q. If you alter the flask, are you not obliged to alter the normal weight, I mean, weighing out the sugar for polarization?

A. I should order for my purpose a true Mohr flask for practical use, always do.

Q. How about the weights used?

A. I use weight in air to correspond to the instrument. The wedge corresponds to the instrument, not the flask.

Q. That is what I wanted to know?

A. But you didn't ask that.

Q. You don't use the Government method?

A. I do very often.

Q. Not always?

A. Not always, because I am not a Government official, if I were I should use the Government always.

Q. Did you not state that by preference you use the other method, that is, the commercial?

A. I did.

Q. The commercial method?

126 A. I did state that. Because I am not supplied with Government flasks. I have my own flask. It is more convenient for me to use the old method.

Q. Well, from your observation of the work done by trade chemists are they not in the same position?

A. They can answer for themselves. I don't know.

Q. You stated that you were somewhat familiar with the work done by trade chemists——

A. I don't think the Government requires trade chemists to use the Government methods.

Q. They don't use it from point of fact, do they?

A. I do not know. Not to my knowledge; not necessary that they should.

Q. You made some reference to raffinose; can you state whether or not in your judgment raffinose exists in the highest grade of refined sugar?

A. There is good authority for it.

Q. What authority?

A. Same that Doctor Weichmann introduced. The author of "Principles and Practice of Agricultural Analysis."

Q. That is Prof. Wiley?

A. Yes, sir.

Q. Can you refer to any other authority on that point?

A. Yes, sir.

Q. What, for instance?

A. Weichmann——

Q. He is rather of an opposite opinion, if I recall——

A. Mr. Herles, Sidersky—(witness refers to page 222, vol. 111, Agricultural Analysis, and states) I will offer it in evidence.

Q. Are you conducting this case or are you a witness?

(No response.)

Q. What is the flask prescribed by the regulations (1897) as the instance of the Coast and Geodetic Survey?

A. You mean its contents?

Q. Yes.

A. It is a flask which holds under standard conditions of temperature and pressure, exactly 100.6 grammes of pure distilled water.

Q. Is that the true cubic centimetre flask?

A. No, sir.

Q. Is that the Mohr flask?

A. No, sir.

Q. What flask is it?

A. It is the official flask of the United States Government in use for the polarization of sugars.

Q. Neither the one or the other of those used in ordinary polarizations by trade chemists?

A. I don't know whether they use it or not; I could not answer that question. They testified here that they had, some of them, here, used it in their work.

127 Q. You stated in your testimony that the differences,—the comparatively small amount of differences—under the new system as compared with the considerable differences under the old

system, are to be attributed to the use of these new regulations, did you not?

A. I stated that under the new system *they* were less differences than under the old. I didn't state to what they were attributable.

Q. You didn't; well, to what do you attribute those differences?

A. I attribute it to the fact that all the chemists are using instruments standardized by the same authority, that they are using flasks standardized by the same authority, that they are using quartz plates standardized by the same authority, that they are using thermometers standardized by the same authority, the polariscopes are all alike, also standardized by the same authority, which is the weights and measures office, the highest scientific authority in this country on weights and measures, established by Congress for that purpose, the office of weights and measures of the United States Coast and Geodetic Survey, Washington.

By Judge SOMERVILLE:

Q. Uniformity of apparatus?

A. And method, yes, sir.

By Mr. TINGLE:

Q. Is the Coast and Geodetic Survey an authority on methods as well as for apparatus?

A. I don't know.

Q. Why do they set themselves up as the supreme authority?

A. I stated that they were the supreme authority to fix these graduations for which they were established by Congress.

Q. Has anybody disputed the correctness of the graduation; have you heard them disputed?

A. I have.

Q. By whom?

A. By every one of these whom you certify as witnesses.

Q. You stated a while ago that the commercial tests are not scientific?

A. I did not. If it is so stated I will strike it out.

Q. Do you regard the tests made by trade chemists, in use by them, as a scientific test?

A. I do. I say under proper—I will modify that; that the method pursued by the trade, when performed under the conditions at which their instruments are graduated, and accurately performed, will lead to correct results. Those were the very words I used in my first testimony.

Q. Do you claim, then, Doctor, that these trade chemists don't use their instruments properly?

A. I claim they don't use them at the temperature at which they were graduated. I think they will all admit it.

128 Q. Is that a violation of the general rule in respect to the use of these instruments?

A. I didn't know that there was any rule in respect to their use.

Q. If that is the case, why, they can polarize at any temperature?

A. That is what they do do; that is the reason they have error.

Q. Can't they do it correctly?

A. Unless they make allowance for temperatures they can't do it correctly.

Q. You stated before lunch that it was possible to obtain a polarization of chemically pure sugar of over 100?

A. Yes, sir.

Q. As high as 100.5?

A. I don't think I did.

Q. By the commercial method?

A. I don't think I said so. Don't make me say what I didn't say. I didn't say anything of the kind.

Q. Have you ever known of such polarizations by the commercial method of testing sugar?

A. I have made by strictly commercial methods, on chemically pure sugar, tests very much over 100 degrees myself, following strictly commercial methods, that is, the instruments and flasks, without paying any attention to temperature at all, and noted them on this table here.

Q. And you found that by correct methods?

A. No, sir; incorrect that result represented a sugar polarization of 100.4 as I have here, and stated that sugar rarely polarized that.

Q. That was the result you obtained?

A. And I obtained a sugar that polarized 100.43 which is not quite pure, either.

Q. But you stated subsequently, Doctor, as I remember—didn't you state afterwards that it was impossible that a sugar could properly test over 100?

A. I didn't say common polarizations could not be more than 100 degrees test.

Q. Didn't you if properly tested?

A. Oh, yes, properly, at 17.5 degrees, with proper flasks and plates, I said that, I spoke about that. You forgot the properly.

Q. It is in testimony—you probably heard it—one of the chemists who testified that over 30%, or about 30% of the samples of refined sugar tested above, or were found to test over 100 by the regulations prescribed by 1897. How do you account for that?

A. I think attributable to the excellence of the American Sugar Refining Company in making such pure sugar——

Mr. TINGLE: Strike that out——

WITNESS: I mean to state that with practically pure sugars with the allowance for variations of individual observers, may go .2 above or below.

129 Q. Suppose it is foreign sugars. These sugars are not domestic, they are foreign sugars?

A. I don't know anything about that; it wouldn't make any difference.

Q. You are not really able to explain how the Government in testing sugars got these results over 100?

A. I have explained this to the board, I will do it again if you wish. Under the conditions used in commercial work and in

laboratories and which are known as the old regulations with .3 variation and under the new regulations with .2 variation, I say that with a practically pure sugar, such as we find in commerce, may have an apparent polarization over or under 100; and I would not be surprised if 50% may go above. Another reason probably some of these sugars were made of very low grade beet sugars and contains a percentage of raffinose, white crystallate sugar, which may increase the polarization. That is what I said before and I repeat it.

Q. You stated that the Government or Coast and Geodetic Survey has standardized the instruments of polariscopes on all temperatures, so as to be correct in use for all temperatures; will you explain how that is done?

A. The instruments are standardized at different temperatures from the range of about 10 to 35 degrees according to the regular mathematical principles which are well understood and appreciable by all of you.

Q. I understand, then, that the Coast and Geodetic Survey office changes the scale upon the polariscopes?

A. They have scale makers. You have got a man here who can answer that. I think sometimes they do change the scale. The standard scale does not mean changing that at all, it means changing its value.

Q. Under the commercial system were the errors both plus and minus errors, all one way or all another—the ordinary work of the trade chemists or the Government under the system prior to the use of the present regulations?

A. I don't understand the question.

Q. I want to know whether the errors or variations between the Government tests and the system that you spoke of in use by the trade chemists, whether those errors were all one way or plus errors?

A. From what standard?

Q. From the mean.

A. They must be variations; the mean is always between the two extremes.

Q. Were they above or below the mean?

A. Why, I don't see how a polarization could be above or below the mean. It is a new principle of mathematics to me. Some are above, some are below; the mean occupies the mean position.

Q. Were the polarizations made by the trade above or below the polarizations made by the Government chemists, generally speaking?

A. That I introduced as evidence here.

130 Q. From your observation generally, what did you ascertain from them?

A. At what time?

Q. At any time prior to the present regulations?

A. My observation—my recollection is that there was practical uniformity from the Government polarizations.

Q. Under the present regulations, how as to variations?

A. All I know is what we have compared, have very few here.

Q. What does that show?

A. Some are above the Government polarizations, most of them are very much below.

Q. The greater part of the trade chemists are much below the Government test?

A. The greater part are below the Government polarizations of the same samples.

Q. How do you account for it?

A. That the trade has not accurately made its polarizations. That is the way I account for it.

Q. How does it happen that the Government polarizers here have testified that over 30% of the polarizations of refined sugar run over 100%.

A. I suppose they told the truth; that is the only way that I could account for such testimony.

Q. The instrument that you used in your investigations—you spoke of a while ago—you stated was more delicate and obtained better and finer results than the instrument used in the trade; would these results have been the same had you used the ordinary polariscope used in the trade?

A. That would have been the result. I could not have measured them so definitely, that would have been the only difference; the results would have been the same, but less accurate measurement.

Q. Then you insist upon measurements which the trade methods cannot execute in the ordinary determinations?

A. I don't insist on any measurements of any kind. I am not here to insist.

Q. Is it not true, then, that the Government prescribes the methods of doing this work and expects results which cannot be obtained by trade instruments?

Judge SOMERVILLE: It would not be competent to call on the witness to testify to what the Government expects.

Q. Don't the regulations prescribe that these methods which you used with your instrument of delicacy and refinement, shall be also used by the chemists in testing sugar for the customs purposes?

A. Why, I testified that I used the trade methods in many of my investigations.

Q. Don't the regulations prescribe methods for testing sugar which could not be followed strictly by polariscopists in the ordinary testing, don't the regulations of 1897?

131 A. The Government don't require trade chemists to follow those regulations and has nothing to do with trade chemists.

Q. Doesn't the Government prescribe these methods and also the use of instruments that are not ordinarily used in the trade?

A. I don't think any of these instruments have ever been used in the trade, not one.

Q. I mean the ordinary Schmidt & Haensch polariscope which the trade uses and which the Government officials use also?

A. If they use a similar polariscope?

Q. Yes, the same kind of polariscope?

A. I don't think the Government prescribes for the trade, only for its own use.

Q. I want to know whether the Government has not prescribed by regulations for the use of instruments in the laboratories which are also used in the trade, aren't the instruments the same?

A. I don't know whether they are or not. I don't know what kind of instruments chemists use over the country. It is a matter that rests with them.

Q. Haven't you stated that you have had the opportunity of very considerable observation of the tests made by the trade chemists?

A. In quite a large number; they don't use the kind they use upstairs in any I have been in (meaning U. S. laboratory, appraisers' office, this building).

Q. How do those differ?

A. They use,—the trade laboratories use the tint instrument in fact, while we use the half shadow instrument, working entirely different.

Q. Doesn't the Government prescribe the use of instruments which are standardized with no greater precision than those used by the trade?

A. Does that call for an opinion or fact?

—. ——.

A. I am willing to give my opinion. I have used both instruments, both kinds; my opinion is that the shadow instrument is far superior.

By Judge SOMERVILLE:

Q. Is there a polariscope prescribed by the Government?

A. Yes, sir; the shadow, which is more accurate. The man who is experienced in reading can read just as well as he can on the shadow instrument.

By Mr. TINGLE:

Q. Is the instrument used by the Government in its laboratories for customs purposes as fine and precise an instrument as the one upon which you made your experiments?

A. No, sir; it is not.

Q. How do you expect these degrees of refinement in results to be reached?

132 A. We don't expect; we allow a variation of .2 which is compensated for by the occasion which I mentioned a while ago.

Q. Is this variation allowed only on the plus?

A. I don't think the regulations say plus or minus; it don't make any difference.

Q. Are not the reported differences so far on the plus side——

A. I don't know that they are. I don't know as I understand your——

Q. You heard the testimony that 30% of the determinations were on the plus side——

A. Then 70% are on the minus side, that makes 100%.

Q. That don't follow at all?

A. The testimony I heard was that 30% were 100, therefore, 70%

must be below 100; that is logical, so two-thirds of them are minus after all.

Q. You heard the testimony of these chemists who have testified for the protestants to the effect that they made experiments with sugar, chemically pure sugar,—and found invariably that they tested by the Government method, prescribed by the regulations of 1897, above 100%, an average of about 100.3; have you any idea or opinion to offer as to the cause of that remarkable result?

A. I have an opinion, I would rather not give it.

Q. You don't mean that you cannot give a reason?

A. I could give it—my impression; of course I have the highest regard for the scientific capacity of these gentlemen; but my opinion is they have made a mistake. Just how or where I don't know. I am absolutely sure that they have made a mistake.

Q. Are you absolutely certain that the error may not have been inherent in the method they were required to use under the regulations of 1897?

A. There could have been no error if they carried out the regulations. I have carried out those regulations with accurate results many times.

Q. You heard the testimony of Doctor Weichmann, Doctor Deghuee, Doctor Wolfbauer and Mr. Sherer, all to the effect that they had made their tests at various degrees of temperature, taking care that the polarizations should be made at the same temperature at which the solution was made up, when that was done was no difference, do you think they were in error in those tests?

A. I am certain of it, absolutely certain.

Q. You mean to say you think them erroneous in methods or testing or what?

A. I don't know, sir; I have no opinion about how they arose. This sheet is a complete answer to that question (referring to Exhibit One).

Q. Do you think that comes within the range of possibilities that three competent chemists, capable men understanding the subject, and making tests independently of each other, and at differ-
133 ent times could come practically to these same conclusions, all making the same identical errors?

A. I am not mathematician enough and cannot apply the doctrine of probabilities.

Q. As an expert and scientific man I would like to have you explain how four chemists of acknowledged ability in following out these regulations of the Treasury Department, making their experiments at different times, independent of each other, should arrive at identically this same result——

Judge SOMERVILLE: That is merely argumentative.

By Mr. GIBSON:

Q. Doctor, you were asked about raffinose, will you please explain what you said in your book in regard to them?

A. It is only three or four lines; I can read it in a moment:

"Such a sugar will, as a rule, not contain more than one-tenth per cent. of impurities, and can be safely used for all analytical purposes. It is assumed in the above that the granulated sugar is made from sugar cane. Granulated beet sugars may contain raffinose and so may show a polarization in excess of 100." (Page 60, paragraph 46, Principles and Practice of Agricultural Analysis, vol. III, agricultural products—Wiley.)

Q. Is there any other paper on which you based your opinion in regard to temperature at these tests, in fact what paper did you refer to?

A. Not a paper but to the results obtained by the Coast and Geodetic Survey with which I am acquainted in standardizing these plates.

Q. That was in connection with the views of Mr. Andrews, was it?

A. Yes, sir; and the results attained by the Coast and Geodetic Survey on my testimony.

By Mr. TINGLE:

Q. Do you know any way by which you can identify raffinose in refined sugar?

A. Identify it? Yes, sir.

Q. Are you able to take a sample of refined sugar and ascertain whether or not it is made of beet or cane?

A. I cannot unless it contains raffinose. There might be a thousand just like it and only one contain raffinose.

CHARLES A. CRAMPTON, called as a witness for the Government, having been duly sworn, testified as follows:

By Mr. GIBSON:

Q. Where do you reside and what is your occupation?

A. Washington; I am a chemist of the internal revenue office.

Q. Will you state what experience and education you have had and training as a chemist?

134 A. I was educated generally in chemistry at the university of Michigan where I received the degree of P. A. and Ph. D., spending four years there, have also a degree in analytical chemistry from the State Agricultural Experiment college and State Agricultural College of Indiana and have also training as a physician. I have had experience in practicing the profession of chemistry first in the Department of Agriculture in 1833 and was there for eight years. As the result of a competitive examination I was appointed under civil service rules to my present position which I have occupied since 1890.

Q. State what experience you have had with the use of the polariscope for testing sugars?

A. I have had very large use of the polariscope during all the time of my professional career. In the Agricultural Department I had very large experience in the use of the polariscope in connection with the experiments which were carried on during that entire time by the department in the development of the domestic sugar indus-

try. I spent a large part of each year upon sugar experiment stations where experiments in sugar were being carried on, involving the use of the polariscope personally and also in the direction of the work of others. After the passage of the act of 1890 which provided for the payment of a bounty upon domestic sugar I was charged with the execution of the work of testing sugars for bounty purposes and during the period of 1890–94 had entire supervision of the testing of sugars by the polariscope, under the control, of course, of the Commissioner of Internal Revenue.

Q. Will you please state fully your connection with the testing of sugars under the act of 1890 on which a bounty was paid on the domestic sugars?

A. At the time of the passage of the act of 1890, which provided for the payment of a bounty by the Government upon sugars of domestic production, I was instructed by the Commissioner of Internal Revenue to prepare a draft of regulations to be issued as instructions under that law. Having knowledge of the difficulties experienced in the customs branch of the service in obtaining accurate and concordant results of polarization in different laboratories, I advised the Commissioner of Internal Revenue at that time to call to his aid the assistance of persons who were skilled in that particular line of scientific research, and to avail himself of their advice. At my request he appointed such a commission as I had recommended, consisting of the chief chemist of the Agricultural Department, Doctor Wiley, the officer in charge of the office of weights and measures and myself. The gentlemen composing that commission were O. H. Tittman, Doctor Wiley and myself. The commission as thus constituted made an effort to give the matter considerable care and study. The instructions issued to these gentlemen were to prepare a draft of regulations for the purpose of submitting them to the Commission as a guide in the regulations which were to be issued governing the polariscopic tests of sugars. The commission
135 met a number of times and the official regulations in use by European countries for testing sugar were consulted by them in all cases where such regulations existed. The commission also availed themselves of the results and experiences obtained in this country in the various investigations conducted by the officers composing this commission. As a result of this work a report was submitted to the Commissioner of Internal Revenue upon which he acted by issuing the regulations which were recommended with the report therewith submitted.

Q. I show you a paper here endorsed "Regulations relative to the bounty on sugar of domestic production under the provisions of the act of Congress approved October 1, 1890," and which has been marked Exhibit 2—— ?

A. These are the regulations in question.

Q. State what was done with those regulations?

A. Those regulations were issued as the official regulations of the office; I was further charged or instructed to supervise the work of testing sugar as provided for therein. In pursuance with that authority I prepared plans for all the laboratories which were erected

or arranged for this work. I supervised all the tests of sugar that were made. I instituted a system of check samples to determine the accuracy of the work and to see that the regulations were complied with as prescribed and carried out. During the operations of that work I had occasion to visit all parts of the country, traveling for that purpose through Kansas and the sorghum sugar district in California, and the sugar beet factories in that State and New Orleans at the opening of the sugar cane season, and New England—Vermont in the cause of maple sugar and established laboratories for the testing of maple sugar. I therefore had personal knowledge of the operations of said regulations during the entire period of the tests of sugar for bounty purposes.

By Judge SOMERVILLE:

Q. Is there any essential difference between the regulations known as the bounty regulations and the regulations of 1897?

A. The essential differences are in the direction of improvements and accuracy and delicacy of instruments and methods employed.

By Mr. GIBSON:

Q. Did you, on your visits over the country that you have stated, find that these regulations were practicable and possible to be carried out? (Those of 1890?)

A. I did.

Q. Will you please state what connection, if any, you had with the investigations of the testing of sugars in the custom house laboratories, previous to the year 1891, or previous to that time?

A. In connection with the regulations for the polarization of sugars under the law of 1883, while I was connected with the Agricultural Department, I was detailed to assist the chemist of the Agricultural Department, Dr. Wiley, in the investigations
136 which were carried on in 1890 as to the efficiency of the work done in custom house laboratories under the regulations of 1883. In that connection I became aware of all the facts incident thereto. The facts which were brought out at that time were largely instrumental in leading me to take the action I did with reference to recommending to the Commissioner of Internal Revenue that he call a commission together to form these regulations (Exhibit 2).

Q. State what, if any, knowledge you have in regard to the preparation of the regulations of 1897?

A. The present regulations were prepared by a commission, constituted by the Secretary in the manner stated by Doctor Wiley. The constitution of this commission was as follows: Doctor Wiley, chief chemist of the Agricultural Department, Doctor Braid in charge of the office of weighis and measures, U. S. Coast and Geodetic Survey and myself. With the substitution for Mr. Braid in place of Mr. Tittman the commission was slightly changed in personnel from the former commission which drafted the bounty regulations. The commission as above constituted held a number of meetings and examined the bounty regulations thoroughly to determine what changes were necessary and which could be per-

mitted with a view of securing accuracy in tests and embodying such improvements in science as was thought expedient. A report was made by the commission to the Secretary of the Treasury and the regulations of 1897 were issued. I may add that a slight change was made in the definition of the polariscopic degree, the method of manipulation of the sugar solution before polarization and the instrument called the triple field shadow polariscope was also permitted. This instrument admits of greater delicacy of adjustment than the half shadow instrument which is in use by the Internal Revenue office.

Q. State if you had any conferences with the chemists who test sugars for importers and buyers as to the method of testing sugars under these regulations of 1897, and state what occurred?

A. The instructions we had directed that we hold conferences in Boston, Philadelphia and New York with the commercial chemists, the purposes of which was to establish an understanding between the Government and commercial chemists in reference to the method prescribed by the Treasury Department, and to fully explain our methods. I participated in all the conferences which were held and at one of which I alone was present.

Q. Did you come across any of the gentlemen who have testified in these proceedings, and if so, which ones?

A. At the conferences I met Mr. Zeller, Doctor Weichmann, Mr. Sherer (Edward Sherer), Mr. Wolfbauer and another gentleman.

Q. State what occurred?

A. Those interviews were informal and the matters discussed were in reference to the scientific criticism of the regulations as
137 prescribed. The fullest and freest criticism of the methods were invited and carried out as to the scientific basis of the regulations. Considerable misapprehension was found to exist among trade chemists in regard to the methods used by the Government. The members of the commission explained to the commercial chemists many points which they had not before understood.

Q. What was the result of these conferences or comparisons and the results reached between you and the gentlemen who have testified here?

A. The result of these conferences was practically the same in each case and the understanding was to the effect that the persons taking part therein on behalf of the trade were entirely satisfied with the validity and accuracy of the regulations, as prescribed by the Government.

Q. Have you any knowledge of the efficiency of the work done in the Government laboratories under the regulations as prescribed under the act of 1897?

A. I have had occasion to pass upon the efficiency of the work as the result of tests of check samples sent to various laboratories, these results having been obtained through official sources. The result of these comparative tests made during the progress of the investigations by the commission were embodied in a report to the Secretary of the Treasury.

By Judge SOMERVILLE:

Q. Are you able to give any opinion as to which of these methods, the one under the bounty regulations of 1892 or the new regulations of 1897 led to the more accurate results?

A. In my opinion the latter regulations led to the more accurate results.

By Mr. GIBSON:

Q. Can you state the results for any particular month?

A. I can state the results. At the close of last month, or the average for the month of October, on 46 samples which were polarized at three different ports varied from each other not more than 1/10 of one per cent. on the grand average.

Q. Does your knowledge in regard to the determination or the practice of these regulations extend over the whole period that they have been in existence?

A. The regulations governing the bounty act, my knowledge extends over the entire period.

Q. In regard to these, covering the act of 1897, these regulations?

A. I thought the question was directed towards those covering the bounty act. The answer I gave was intended to cover a portion of the period covered by the new law of 1897.

Q. You have knowledge of the results of tests under these new regulations during the whole time that they have been in
138 existence?

A. In this way: By being cognizant of the results obtained upon the system of check samples and knowing that it was carried on.

Q. State if you found the efficiency and accuracy of these tests as carried on under the regulations (1897) have been more satisfactory than the results under the regulations of 1890 and 1883?

A. I cannot very well compare the present regulations with those of 1890, carried on under very different conditions; but I am of the opinion that the results obtained by the present regulations in the customs service are efficient and accurate and very much improved over the results obtained in 1883, under the law of 1883.

Q. Have you found in your experience in testing sugars by the polariscope that the temperature exerts any influence upon the polarization of a sugar solution?

A. I have.

Q. Well, to what extent?

A. To an extent amounting to about .03.

Q. Have you any knowledge of the correctness of Dr. Wiley's report (Exhibit 1) that sheet of paper there, tests relative to temperatures?

A. Not by actual participation in the experiment; only a comparison of that with other authorities upon the subject.

Counsel for protestants objects to last answer.

Q. Well you please state how this matter of influence of temper-

ature upon the polarization of sugar solutions was brought to your attention?

A. In the first place by the investigations which were carried on in 1890 in connection with customs laboratories, also the investigations conducted by Prof. Andrews of the Boston Institute of Technology and Mr. Tittman of the Coast and Geodetic Survey.

Q. What was the effect of the variation in temperature?

A. The effect of the influence of temperature upon polarizations of sugar exerts itself to the extent of about .03 for each degree centigrade.

Q. Was this influence of temperature known at the time the regulations were formulated by the internal revenue office in regard to bounty on sugar?

A. It was known from the investigations of Mr. Tittman who was a member of that commission and it has since been brought sufficiently in the journals devoted to sugar analysis and sugar journals in general and by papers written by well known authorities and it is a well recognized fact in sugar chemistry that the temperature does not exert an influence upon the polarization of sugar solutions.

Q. Can you make any statement in regard to the scientific accuracy of this system?

139 A. The present system of——

Q. In regard to the tests by the polariscope?

A. My general opinion of the accuracy? My general opinion of the regulations of 1897 is that they are very accurate and lead to accurate results.

Q. Did you have any conferences with chemists in regard to the influence of temperature upon tests of sugar by the polariscope?

A. There were one or two chemists who were in these conferences who had knowledge of the influence exerted by the temperature.

Q. Were those two chemists who testified here?

A. Neither of them.

Q. What control has the influence of temperature upon the polarizations; does it raise or lower the polarization?

A. The rise of temperature lowers the specific rotation of the sugar.

Q. Lowers the polariscopic test?

A. The apparent specific rotation of the sugar.

Q. And lowering the temperature has the other effect, does it?

A. Has the opposite effect where the polarization is made below, yes, sir; it has the opposite effect.

Q. That is what you mean by the practical result upon this so-called sugar test?

A. The practical result of this has reference to the standardization of the instrument employed. Polarizations in this country are conducted at a temperature of 17.5 degrees centigrade. If the polarizations are made at a temperature above or below that standardization the temperature influence is manifest either way from this prescribed temperature.

Q. In regard to those polarizations of sugar—refined sugar; state,

if you can, whether it is possible for such sugar to be polarized over 100?

A. It is not possible for an absolute polarization of sugar to go over 100 degrees; the absolute true polarization, the absolute content of sugar.

Q. Well, if in case there has been polarization above 100, will you please state how this is possible?

A. It may happen from the temperature, in variations of temperature and not being corrected; it may occur, of course, also in reading the instruments, which are not corrected by the proper means.

Q. Any other reasons?

A. There may be sugar present which has a different rotatory power from suc-ose.

Q. May there not be variations on account of the observer, the individual observer?

A. The individual observer, or what I suppose may be called in polarizations the personality of the observer. One observer might read his instrument a little too high or a little too low.

140 Q. Are you familiar with the methods in use by commercial chemists?

A. It would be impossible for me to explain their method. I know of no one method which they go by and could state in detail as being the one commercially followed.

Q. Have you been to any extent in the laboratories of the private chemists or chemists who work for the sugar importers?

A. I have been in the laboratories of trade chemists so-called, also in the laboratories of different refineries of the country.

Q. Have you observed their method of testing sugars by the polariscope?

A. Only to such extent as was possible from a cursory observation of their instruments and means and methods employed.

Q. Can you state whether they were the same as those employed by the Government?

A. I could not give any opinion of any value upon that point.

Q. Is it uniform throughout the country, or not the system?

A. The regulations prescribed by the Treasury Department are supposed to be uniform at the different important points.

Q. Why were these regulations adopted by the Government? Have you any opinion about it?

Objected to by protestants' counsel; objection sustained.

At 4 o'clock the board adjourned until 10:00 a. m., December 17, 1898.

DECEMBER 17, 1898—10:00 a. m.

Hearing resumed pursuant to adjournment.
Present: Same as before.

Testimony of CHARLES A. CRAMPTON continued.

By Mr. GIBSON:

Q. Doctor, who were present at the conferences of the board or committee which you testified to at Boston, if you remember?

A. The conference at Boston was held by myself alone, as representing the commission, the other members not being able to be present. Prof. Sharpless, Prof. Stevens and Prof. Leo Pickert, the chemist of the American Sugar Refining Company, and Mr. Chevelier.

Q. Will you state what were the important points or objections they made?

A. The important points named, in the first place, Prof. Sharpless objected to the use of the flask which the Government had adopted. This gentleman, I believe, stated at the conference held in Boston that he used a correction factor for differences in temperature of .025 for each degree centigrade. I think it was Prof. Pickert, however, who made this allowance for temperature.

141 Q. Was he a trade chemist or Government chemist?

A. He stated that he was the chemist of the American Sugar Refining Co.——

Judge SOMERVILLE: Mr. Tingle, do you have any objections to that question?

Mr. TINGLE: I object.

Objection sustained.

Mr. GIBSON: Doctor Crampton, having paid a great deal of attention to this matter felt it to be his duty to make this statement for the information of the board.

Judge SOMERVILLE: What relevancy would it have upon the issues in this case that parties had met somewhere and talked the matter over, unless some action was taken by vote or otherwise, by that body.

Mr. GIBSON: Doctor Crampton had charge or the supervision of the collection of the bounty paid to sugar producers, and the claim made by the people receiving the bounty was that the Government test was too low.

Judge SOMERVILLE: What difference would that make?

(Mr. GIBSON:)

Q. Did any of these chemists at Boston claim that there was any peculiar size of flask?

Mr. TINGLE: I object to that, your honor.

Objection sustained.

Q. Did any of them testify that they used a correction for temperature?

Judge SOMERVILLE: Those statements are not under oath. We rule that out.

Mr. GIBSON: I have one or two questions I wish to ask along this line and I will state them for the record.

Q. In your experience in connection with the bounty regulations what knowledge did you have of any protests or objections made against tests of sugar by the polariscope?

Objected to; objection sustained; question excluded.

Q. What was the nature of these protests?

Objected to; question excluded.

Q. What are the latest published methods for the use of the polariscope?

A. The publications in the literature relating to sugar chemistry——

Objected to; witness allowed to answer.

142 A. The latest methods published, to my knowledge, in the literature relating to sugar chemistry, are the resolutions of the Austro-Hungarian chemists, engaged in the sugar industry. Their meeting was held at Buda Pesth, June 22, 1898 (Zeits. angew. Chem., 1897, 123–126). The methods adopted by this organization are given, and I will read one paragraph which has a bearing on the controversy here——

Mr. TINGLE: I beg your pardon, I don't think that has anything to do with the method adopted here.

(WITNESS:) These are trade chemists.

Judge SOMERVILLE: Read the article.

(WITNESS, reading:) "For clarifying and decolorizing, bacic acetate of lead may be used (3 parts of lead acetate, one of litharge, 10 of water), concentrated solution of alum and Scheibler's colloidal alumina. Char and decolorizing powder are absolutely excluded. For sugars polarizing over 99, alum or colloidal alone will suffice.

This bears upon the point made by the witness that the use of alumina cream was unusual and wrong:

"* * * for first products, 1 C. C. of acetate of lead and 1 C. C. of alum solution; and for after products, 2 to 3 C. C. of acetate of lead, 1 to 2 C. C. of alum solution for each 100 C. C."

"For the polarization of first products, at least the normal weight should be weighed out, dissolved in distilled water without the aid of heat, and after clarifying, made up to 100 C. C. at the ordinary temperature, not too far from 17.5 degrees C."

By General Appraiser TICHENOR:

Q. What body was that?

A. These are resolutions adopted at the meeting of the chemists in Austro-Hungary, held at Buda Pesth.

Q. Have you any personal knowledge as to the character and standing of the members constituting that body?

A. In the way that they represent the sugar trade chemists in that country. I know it to be a fact so far as my knowledge of the literature is concerned.

Q. Do you have any personal knowledge of the character, qualification and standing of any members constituting that society?

A. Know as knowing in that country they must necessarily be chemists.

By Mr. GIBSON:

Q. What authorities can you give in support of the contention and testimony that temperature exerts an appreciable influence on the polarization of sugar?

A. I can quote, I think, in addition to any and all the authorities which were quoted yesterday, an article which I have taken from the same journal that this (article just read) is taken from; the journal devoted to the interests of sugar chemistry. This (another paper produced by witness) is taken from the same journal.

143 The author is Sachs, published in Zeits. Ver. Rubenzuckerind, 1898 (46, 264); he also quotes Pellet (La Suc. Indig., 1896; 31, 494) and Wartze.

The two papers produced by witness and last referred to are marked in evidence Exhibits 4 and 5, respectively, 34769-F, December 17, 1898.

By Mr. TINGLE:

Q. You testified yesterday that you had had large experience in polarizing sugars, did you not?

A. Yes, sir.

Q. What experience did you have,—how long experience did you have in the Agricultural Bureau?

A. Eight years.

Q. Engaged in——

A. Seven years, 1883 to 1890.

Q. Engaged in polarizing sugar all the time?

A. That was a part of my duties in the Agricultural Department.

Q. Had you, during that time, any experience with regard to commercial tests of sugar,—chemical tests of imported sugar?

A. No.

Q. What was the character of the sugar which you tested?

A. All kinds, raw, refined sugars, sugar house products and juices, syrups and molasses.

Q. What method did you pursue in testing?

A. At that time I followed sometimes one method—that is, sometimes a slight modification of a method,—of one method; no particular detailed method, except those that were in general use.

Q. Meaning what by "general use"?

A. Well, methods that were in vogue at that time.

By Judge SOMERVILLE:

Q. You mean in the trade?

A. No, in science.

Q. Was there a different method used at that time in the trade and in science so-called?

A. I suppose they followed actual scientific methods.

By Mr. TINGLE:

Q. Please describe the methods you used at that time?

A. It would be impossible for me to describe it now in every minute detail.

Q. In a general way, as to the flask used and methods pursued in arriving at the test—as to weights used and flasks used?

A. One hundred cubic centimetre flask, the weight used——

Q. What kind of a cubic centimetre flask?

A. Well, I presume—I have to give—because I can't tell—

144 you intend to have me say that the flask used was in general the Mohr flask.

Q. I want to know what kind it was?

A. It was a 100 cubic centimetre——

Q. What kind of cubic centimetre, are there different kinds?

A. I don't know that there——

Q. Don't you know that the Mohr cubic centimetre differes from the true cubic centimetre flask?

A. I know that differs from what is known as the true cubic centimetre, yes.

By Judge SOMERVILLE:

Q. Did you use the methods prescribed by the department regulations under the act of 1897, to which reference has been made by witnesses heretofore, or a different method?

A. A different method, because those regulations were not at that time in existence.

Q. Have you familiarized yourself with the method which prevailed under the act of 1883?

A. Yes, sir.

By Mr. TINGLE:

Q. Was the method you used at that time similar to that used under the act of 1883?

A. Very similar, it was.

Q. Then it was what is known as the Mohr cubic centimetre flask that you used?

A. Yes.

Q. You used the Mohr flask?

A. I did.

Q. Did you regard the tests that you made at that time as correct tests, by that method?

A. I did.

Q. Do you know whether or not they were correct tests?

A. I have no means of knowing.

Q. Do you know whether they were correct tests or not?

A. I think they were as correct as an ordinary individual could make them, yes.

Q. When you went to the Internal Revenue Bureau, did you participate in the preparation or formulation of the new regulations used for the collection of bounty, or the ascertainment of the sugar upon which duty was to be paid?

A. I was the chairman of the commission who prepared those regulations.

Q. Please state, then, the reasons for departing from the method which you employed in the Agricultural Department, which you say was a correct method, and gave correct tests, and adopting the new method?

A. I would like to——

145 Q. Please state those reasons?

A. It would be necessary for me to say, in the first place, of the manner of changing it—or the slight modification of a method, because the method cannot be taken in its entirety and prescribed pro or con as an entirety, unless every detail is at the same time carried out. I will say that the question was weighed by the department from the same details from the methods previously used in the regulations at that time prescribed——

Q. I want to know why you made those changes?

A. The reasons were chiefly with respect to the allowance for temperature; it was probably the main essential point, and the difference in the flask; it was another essential point, and were based upon the recommendations chiefly of Mr. Tittman, who was a member of the commission from the Coast and Geodetic Survey, who was supposed to be and was especially qualified to speak with authority on the subject of standards.

Q. I want to know why those changes were made?

A. For the reasons that I have given.

By Judge SOMERVILLE:

Q. Any other reasons?

A. Those, and the general reasons that we desired to make these methods as accurate and correct from a scientific point of view—any changes were designed to be in the direction of greater accuracy.

By General Appraiser TICHENOR:

Q This was done on the instance of Mr. Tittman. Did his recommendation commend itself to your judgment, your experience?

A Very greatly. I considered his judgment superior to my own, superior also to Dr. Wiley's, because that was the branch of the subject for which this gentleman was chosen.

Judge SOMERVILLE:

Q To establish a system which led to more accurate results, you think?

A. I think I so stated yesterday. I think the last are the more accurate——

By Mr. GIBSON:

Q. Meaning the new regulations of 1897?

A. Just as the last published regulations are usually more accurate than those of a year ago, or 20 years ago.

By Mr. TINGLE:

Q. Were not the changes that were introduced in these new regulations fundamental in their cha.acter?

A. I do not so regard them. It is a matter of opinion as to what is and what is not fundamental.

146 Q. Didn't you introduce an entirely new factor in the quartz plate?

A. A new factor in its sense as controlling the influence of temperature, not as controlling the accuracy of the instrument in itself.

Q. Then, is not this question of temperature, according to your view, of fundamental importance?

A. Fundamental in respect to refinement of accuracy, yes; not fundamental in respect to general accuracy.

Q. Well, what do you mean by "refinement of accuracy" and "general accuracy"?

A. Those are relative terms. A man may throw a ball at a mark and hit it precisely in the centre, he may throw again and come very near to it.

Q. Do you mean by that that the temperature question is essential in the scientific test, as compared with the commercial test?

A. Well, I have made no distinction between the commercial and scientific tests. The commercial tests are scientific, so far as they go—aimed to be scientific.

Q. Well, in the commercial method, no attention is paid to the question of temperature, as you have stated, that you are aware of?

A. I will have to qualify that: My under-tanding of the influence of temperature in connection with what you call commercial tests or method, is, that no attention is paid to the influence of temperature apart from the temperature at which the instrument is standardized; that the influence of temperature as corrected by the quartz plate is neglected in commercial methods.

Q. And yet you say that the commercial method is a scientific method?

A. Scientific in its way.

Q. As far as it goes?

A. Yes, sir.

Q. Is that sufficient for all purposes of commerce, do you so regard it?

Objected to.

Q. I will ask you, Doctor, whether, if the regulations as prescribed, in regard to care being taken that the solution shall be made up for polarization at the same temperature, are carried out, will the temperature then affect the question of the test?

A. If the instrument is used—I must take a short cut to all these answers and I will have to qualify in every case—I would say that the test, the polarization of the sugar, when performed upon the instrument which has been standar-ized for a certain temperature, when the polarization is conducted at that temperature, the influence of any variation may be neglected—does not enter into the matter at all.

Q. How can there be a variation if it is made at that certain temperature of which we spoke?

A. There can be none.

147 Mr. TINGLE: I will ask that the question be read.

Last question read and one preceding it and answer.

WITNESS: I could not answer that question specifically yes or no.

Q. You don't regard that as an answer to my question, do you?

A. I have not answered that question so far as I know.

Q. Supposing the temperature differs from that which the instrument is standar-ized and while the temperature of the room in which the work is done differs from the temperature at which the instrument is standardized by the makers, the polarizations being made at the same temperature at which the solution is made up, will there be a variation? Will it be necessary to make a correction on account of the temperature in order to arrive at the proper result?

A. That is a hypothetical question; supposing what?

Question read.

A. I say there would be a variation which would be necessary to correct.

Q. Do you know, Doctor, that in making that statement you are in direct conflict with the highest authorities on this subject, save Mr. Andrews and Doctor Wiley?

A. No; I am aware of the converse of that. There are authorities to the contrary.

Q. Please name the authorities?

A. The authorities which I have already quoted and introduced, also Prof. Landolt in his latest work on the use of the polariscope and also the work of Mr. Tittman and Prof. Andrews and Doctor Wiley, he was quoted here yesterday.

Q. You quote Doctor Landolt as one of your authorities?

A. Yes, sir.

Q. Did you know—isn't that the only quotation from Doctor Landolt on that work—on that point?

A. No, I didn't——

Q. Have you——

A. I think it will be necessary for me to refuse to answer these questions soon.

Q. Have you seen the original article from which Doctor Landolt quotes in regard to that subject?

A. What article is that, what is the title of it?

Q. The one bearing on the influence of temperature or the specific rotatory power of sugar?

A. I have never seen that article.

Q. Then you are not prepared to say whether Doctor Landolt misquoted that article or not?

A. No.

Q. You are familiar with Doctor Andrews' work on this matter are you not?

A. With the publications of it.

Q. Can you state that the formula given by Doctor An-
148 drews at the end of his paper, which formula is the mathematical expression of the results and examinations, is correct?

A. I could not.

Q. Do you know whether or not it is wrong?

A. I could not now make—I am not sufficiently a mathematician to solve that question now without some study.

By Judge SOMERVILLE:

Q. It would need some investigation to form an opinion, some calculations?

A. Yes, sir.

By Mr. TINGLE:

Q. You don't know whether Doctor Andrews was correct or not?

A. I take his statement as being the result of his work. He is liable to error just as all men are.

Q. Then the regulations of 1899 for testing sugar under the bounty act, being based in part upon Doctor Andrews' work, may be wrong, may they not?

Objected — by Government counsel.

Q. Are you familiar with Professor Wiley's Agricultural Analysis?

A. Yes, sir.

Q. Have you that work with you?

A. No, sir.

Q. You are familiar with its contents in a general way?

A. Yes, in a general way.

Q. Do you know whether or not the edition which was consulted yesterday in his testimony has had a large sale?

A. I know nothing about it.

Government counsel objects.

Q. Do you know whether the edition that was published in 1897, which was in evidence yesterday, has ever been recalled for the correction of any errors in it, and which Doctor Wiley stated it contained?

Counsel for Government renews objection.

A. I have no knowledge. You should have asked Doctor Wiley.

Q. If the method or regulations of October 27, 1897, is correct, does it not follow that the methods previously employed by the Government were wrong?

Mr. GIBSON: I object to that as irrelevant.

Question excluded.

Q. You heard the testimony of these witnesses on the side of the protestants in regard to the tests made by them of chemically pure refined sugar, didn't you?

149 A. I heard considerable part of that testimony, not all of it.

Q. Were you present during the examination of Doctor Weichmann?

A. I think I was.

Q. Then you heard his testimony?

A. I think I did.

Q. Can you give a reason, a scientific reason, to account for the results of those tests showing refined sugar to test more than 100?

A. I can only give the reasons I gave I think in my direct testimony yesterday.

Q. What are those?

A. I would like to go back to that part of my testimony.

Judge SOMERVILLE: No; you can't do that. You are called upon to answer the question now.

A. Please state it again.

By Mr. TINGLE:

Q. Can you give a scientific reason why the tests of chemically pure refined sugar should test more than 100 degrees?

A. I can give various reasons why the apparent polarizations of a very pure sugar should go over 100. I did yesterday in my direct testimony.

Q. Go on and give them now.

A. The apparent polarization of a sugar may go over 100 on account of the sugar being so absolutely near 100 with the attempts to ascertain the absolute polarizations in apparent polarizations, it may go over 100 in some cases.

Q. Then, am I to understand you to say that under these new regulations there are apparent results and results that are real?

A. I said nothing about the present regulations.

Q. Yes, we are talking about them?

A. We are talking about Professor Weichmann's experiments as I understand it.

Q. Under the new regulations?

A. He made those under the present regulations?

A. Made them under both, his testimony showed?

Judge SOMERVILLE: Let him state facts.

By Mr. TINGLE:

Q. Am I to understand then that there are apparent and real results?

A. There are always what we call apparent and real. We call it in scientific work absolute and apparent usually. Absolute, if I may qualify, absolute is something like the word infinite. Absolute accuracy is only known in Heaven; whereas, apparent, is what is known in practice.

Q. If the sugar that was used in those experiments tested 99.98 upon scientific analysis, and the record showed that under the
150 new regulations it tested a hundred and four, would that be an allowable margin for an apparent error or an apparent test?

A. You mean four-tenths an allowable margin for——

Q. No, no; as between 99.98 and 100.4; is that an allowable margin?

A. You mean within thirty-eight one-hundredths? I am trying to get the question so I can answer it yes or no.

General Appraiser WILKINSON: A difference of .42.

WITNESS: I should say that was too large a margin.

(Mr. TINGLE:)

Q. How much too large?

A. Well, it is impossible to state those things exactly; but it is too large.

Q. How much margin would be allowed?

A. That depends upon the nature of the work; but that margin is too large.

Q. Have you tested any refined sugar that showed more than 100 on the scale?

A. Apparent polarizations?

Q. Yes.

A. Yes, sir.

By Judge SOMERVILLE:

Q. Under what method?

A. Under various methods.

By General Appraiser WILKINSON:

Q. If you had one hundred samples of sugar and thirty tested 100.3, would the inference be that the other 70 showed wrong tests also?

A. I think not.

By Mr. TINGLE:

Q. Do you regard the corrections made for temperature under the present regulations and the tests thus arrived at, as the real or apparent tests?

A. They are apparent tests. The real, you mean the absolute polarization of the sugar that is as far as it can be ascertained.

Q. Is that the apparent test?

A. It is designated as the test to be used for the classification of the sugar—for classification purposes.

Q. Then the sugar is to be classified under these new regulations upon an apparent test?

A. Yes, sir.

Q. You heard the testimony of Doctor Weichmann; supposing the testimony shows that Doctor Weichmann and the other gentleman who testified here in regard to the experiments they made with the two methods of testing sugar, the commercial method of

151 testing sugar, so-called, and, under the method prescribed by the recent Treasury regulations—showed that the tests under the commercial method invariably tested less than 100 and very near to the real test of 99.98; while the tests under the new

regulations tested more than 100, and in some cases as high as 100.4, how would you account for that fact, I mean as an expert?

Objected to as immaterial and irrelevant; objection sustained.

Judge SOMERVILLE: You can ask him if he has made any tests.

By Mr. TINGLE:

Q. Have you made any experiments—any tests of sugar since these new regulations went into effect and by the old methods?

A. Yes, sir.

Q. State the results.

A. I have not the results with me. I can only state from recollection.

Q. State as near as you can.

A. To the best of my recollection the results obtained by the two methods were practically the same.

Q. Did you make those tests at different temperatures?

A. Yes, sir.

Q. What?

A. Some were made at certain temperatures, others were made——

Q. What temperature?

A. I had not finished yet—at temperatures at which the instrument was standardized.

Q. What temperature was that?

A. 17.5 degrees centigrade.

Q. You found an agreement between the methods—in your tests that you made at 17.5—did the methods agree then, the results, I mean?

A. These experiments I am speaking of.

Q. Did the methods agree when the tests were made at 17.5 at which the instrument is standardized?

Mr. GIBSON: I object to that; there is no method.

Q. Were the tests you made at the temperature of 17.5, at which the instrument is standardized, by both methods—were they substantially in harmony?

A. I can answer it by qualifying——

Q. You stated a while ago that you found the results practically the same?

A. I made a comparison between the two methods.

Q. I want to know whether the tests made at 17.5 agreed?

A. I say that the results by the two methods carried out in detail, which was the commercial method and the present method of the Government, that the results attained of the same sugar, practically agreed——

152 Q. At 17.5?

A. —what has been described as the method.

Q. I am asking now on this temperature question——

A. It is on the influence of temperature, to ascertain that influence that these experiments were made.

Q. I want to know whether the tests made at 17.5 agreed?

A. These tests were not made at 17.5; one test was made at 17.5 and the other was not made at 17.5.

Q. They were not made at the same temperature?

A. I didn't say they were made at the same temperature.

Q. What substantial benefit or information did you derive from tests made at different temperatures?

(No answer.)

Q. You stated that you made comparative tests of this sugar by two methods?

A. Yes, sir.

Q. As the question of temperature was known to be taken into account by the two methods, you must have made the tests at the same temperature?

A. No,—no, sir.

Q. How can you arrive at any comparison of the two methods?

A. Because the two methods were tested, not to ascertain,—not polarize by that same temperature, but to test the two methods.

Q. If the temperature is essential in this matter how could you make any comparison by leaving out of the question the temperature in one method and introducing it into the other?

A. In one case the temperature was made,—was constant, it was always the temperature of the instrument, that is the commercial method, in the other case——

Q. You mean the temperature of the room?

A. —and in the experimental test, commercial method, were made at 17.5; the other method——

By Judge SOMERVILLE:

Q. You mean the temperature of the room was always at that figure?

A. As near as possible, yes. We made a calculation upon the other method. We made the polarizations at different temperature and introduced the correction of the temperature.

By Mr. TINGLE:

Q. You mean to say that you did not make these comparative tests at the same temperature?

A. I did not make them at the same temperature.

Q. Of what value were they as comparisons?

A. They were comparative simply in respect to the two systems.

(Witness addressing board:) Am I required to argue this matter with the counsel for the other side?

153 Judge SOMERVILLE: You can answer facts. If you are not able to recall, you can say so.

Mr. GIBSON: Pardon me——

By Mr. TINGLE:

Q. I want to know whether he took into account the question of temperature when he was testing these sugars under the commercial method?

A. I did.

Q. In what way?
A. In way of making use of that temperature in the polarizations which I made.
Q. What temperature was that?
A. 17.5 C.

By Judge SOMERVILLE:

Q. How did you use it?
A. I maintained that temperature during the performance of the polarization.

By Mr. TINGLE:

Q. You must have made tests by the new method at 17.5 C. to compare with it?
A. I made a number of tests.
Q. Did you make any tests to compare with that?
A. I have made a number of tests.
Q. Did you make any test——
A. I have not those notes with me. I cannot testify as to the details in regard to them.
Q. Can you state whether you made a test of sugar by the new regulations to compare with the test you made under the commercial regulations at 17.5?
A. I made a great many tests, yes.
Q. At what temperature did you make the several tests?
A. I made a number.
Q. At that temperature?
A. At that temperature.
Q. Did you compare them with the commercial at that temperature?
A. With the results obtained by the commercial test at the same temperature.
Q. And found the results practically in harmony?
A. I have already testified as to the general conclusions I drew from those experiments. I will not testify further as to any details.
Q. You cannot give a specific answer to that question as to whether the tests made at both temperatures agreed or not?
A. I cannot.

154 By Mr. GIBSON:

Q. Do I understand from your statements here that when you made a test according to what is called the commercial way of testing sugars, and then made a test at the same time under the same conditions under the regulations of 1897, did you make an allowance of temperature in coming to a conclusion as to the comparison of the two methods, of the two systems? Please explain the matter to the board?
A. I made allowances for temperature by using the quartz plate which is provided by the regulations.
Q. In regard to the presence of raffinose in sugar; state whether

or not the method has anything to do with the fact whether it tests apparently above 100 or not?

A. The method has nothing to do with the absolute polarization of the sugar which is of course exactly 100.

ANDREW BRAID, called as a witness for the Government, having been duly sworn, testified as follows:

Counsel for protestants suggests that Mr. Braid's testimony be confined to the question of flasks.

By Mr. GIBSON:

Q. State your name, residence and occupation?

A. Andrew Braid, assistant in charge of weights and measures, U. S. Coast and Geodetic Survey, and at the present time in charge of the weights and measures office. My residence is Washington.

Q. How long have you been in such position?

A. I have been in the Government service 29 years, a little over, been in charge of the weights and measures office since 1885; and prior to that time also in charge of the office at times.

Q. And in what branch of the service are your duties confined?

A. My services have been in various branches of the service; at the present time I am in charge of the weights and measures office, as I say. I was also for four years in charge of the instruments division of the Coast and Geodetic Survey and of course have had a large amount of experience in handling instruments of delicacy and precision so that my experience in that line has been quite considerable.

Q. What in a general way, is the duty of the department of weights and measures of the Coast and Geodetic Survey?

A. That is so well known it hardly is worth while for me to give it in detail. It is the authority by law for the standardization of various instruments used by the agricultural colleges and various departments of the Government and for institutions of learning.

Q. It is a scientific branch or body, is it?

A. Yes, sir.

Q. You standardize all instruments, do you, that are used by the Government of these societies?

155 A. We supply instruments when we are called upon to do so, certain instruments we are required by law to furnish.

Q. Please state if you had anything to do with the regulations promulgated by the department in 1890 in regard to testing sugar for bounty purposes?

A. I am familiar with those; had nothing to do with getting them up. My predecessor in office was the one who was called upon for that.

Q. With the regulations which are in evidence here? As Exhibit Regulations of 1897?

A. I was a member of the commission that framed those regulations, Doctor Wiley, Doctor Crampton and myself.

Q. Will you please state in a general way what part you had to do with getting up those regulations?

Judge SOMERVILLE: That won't be material. We know they were gotten up, and promulgated by the department.

Government counsel objects and states that witness should be allowed to answer the question.

Q. Will you please state, what, if anything you had to do with the flask which is called the cubic centimetre flask which is used in the polarizations of sugar by the Government, under the law of 1897?

A. I will simply say that the standard flask, quartz plates, tubes and polariscope, used in the polarization of sugar at custom houses, the flasks which they have been furnished, have been the true cubic centimetre, not the Mohr. That change was not made under my administration, but made under my predecessor, when the sugar bounty law, regarding the use of such apparatus in the internal revenue service was established.

Q. You were in the office at that time?

A. Not in charge of the office of weights and measures,—so that the substitution of the flask occurred at that time. The original definition of the Ventzke scale as used contemplated the use of the true flask instead of the Mohr flask, but the Mohr flask did not come into use with us, consequently the weights and measures office has never recognized the Mohr flask. The international chemists also used the true flask, at least they used such flasks as they found in the market which they corrected into the true flask by making proper corrections. Provided the necessary corrections are made you can use a flask of any capacity, provided you know the quantity in weight of sugar and volume of water used in making your corrections in reading and correcting. It does not matter what the flask may be.

By Judge SOMERVILLE:

Q. Are you able to say why a change of flask has been made and what the difference is between the flasks?

A. Well, as I understand the matter, in the first place, our
156 office has never recognized the Mohr standard because it is fictitious. It is not a 100 gram flask, but contains 100.22 cubic centimetres made by weighing out at a temperature of 17.5, one hundred grams of water. It is really a 150 cubic centimetre flask grams, instead of 100 cubic centimetres. No error in polarization would be introduced on this account, provided the quartz plates and other apparatus used in connection with it were standar-ized on the same basis. Another reason is that the National Academy, in the work which they concluded in connection with this subject, used the true flask; and in the third place, the work which was done in experiments for the customs department used the true flask and adopted it, and consequently it would not look well for the office of weights and measures to furnish two kinds of standards to the Treasury Department. They should be uniform.

By Mr. GIBSON:

Q. A quart bottle could be used if the contents was accurately known, just as well?

A. If you knew the contents of it yes.

Q. In regard to the control plates, will you please state the reasons why the regulations adopted the system they do in regard to those quartz plates or control plates and their standardization?

A. The use of quartz plates is well known. It was not introduced by our office; they are used generally. Those plates come from makers with certain marks or values on them which are to correspond to a certain sugar solution of a certain strength. For instance, a plate which is marked 100 rotates a plane of polarized light through the polariscope and through the same angle as the 26.048 grammes of pure sugar made up to a volume of 100 cubic centimetres at a temperature of 17.5, and it is immaterial whether you take the Mohr or the other flask and in correcting for this difference in the flask there was a tendency to introduce error in the result. There is a difference of .17 of a cubic centimetre between the Mohr flask and the true flask furnished by the weights and measures office. There are several methods which might be employed to make this correction. In the first place we might have changed the normal weight of the sugar, taking a proportionate amount of the 26.048 grammes. That might have been adopted. Or the length of the observation tube might have been changed; the assigned value of the quartz plate might have been changed. This latter was adopted and the result is easily obtained, consequently the quartz plates standar-ized by our office have for the 100 point the correction .17 applied to the marked value of the quartz plate.

Q. You take these various quartz plates used in the polariscope in testing and you make a test of them in your office?

A. Yes, we examine every plate very carefully and give it a value. We show the sugar value of these plates at every degree between 10 and 23 C., at every degree between those limits. All the
157 operator has to do is to note his thermometer, which we will suppose reads 23, he glances at his table on the line of 23 and takes out the value from that.

Q. What was the object, Doctor, of making this table?

A. To save the operators at custom houses the time necessary to make computations which they would have to make without them.

Q. To insure scientific accuracy?

A. That prevented their making mistakes and saved time.

Q. Will you please state whether these quartz plates that you have mentioned and these flasks that you have mentioned, which you standar-ize, are used throughout the Government service in the testing of sugar?

A. They are required to be used, I presume they are.

Q. Is there any other instrument besides these two that you standardize for use in testing sugar?

A. The polariscope itself, the quartz plate, the flask, the observation tubes, that is all.

Q. Are those all? You test all the instruments, do you, in your office and standar-ize them, that are used in the testing of sugars?

A. Yes.

Q. Now, will you please state in a general way what object, if any, there is in doing this?

Judge SOMERVILLE: We all understand that. It follows necessarily from the law.

Mr. TINGLE: We don't question any work of the Geodetic Survey.

(Mr. GIBSON:)

Q. Can you state anything in regard to the testing of the polariscope by your office that would show that it is in the way of accuracy or greater perfection?

A. I don't understand your question.

Question read.

WITNESS: I don't understand.

Q. State whether or not the instrument—polariscope used now, by the Government, standar-ized by your office, is more perfectly standardized——

A. This is the form of polariscope manufactured by Schmidt & Haensch (witness pointing to polariscope on desk); it is known as the half shadow instrument. There are higher grades of the same instrument made by the same makers, better workmanship, which gives a greater degree of refinement and accuracy than this one would give. This (polariscope on desk) is superior to the average instrument used in the trade.

By Judge SOMERVILLE:

Q. Is this instrument used in other countries?

A. Used in Germany and in other countries.

158 Q. France?

A. No, sir; they use a different instrument there; they use a true flask and use different normal weight of sugar.

By Mr. GIBSON:

Q. Will you please state what instrument is prescribed to be used under the present regulations?

A. This Schmidt & Haensch, half shadow——

Q. The triple, what is——

A. This is half shadow. There is a larger instrument of an improved form that is called triple field, circular field divided into two halves.

Q. Do you know whether or not the Government is using any of these new or most improved instruments that are known to science?

A. Yes, with that exception; there are more expensive of this same kind; the Government is not using that, using this (indicating) form, which is accurate enough for the purpose intended.

Q. Is the other form allowed?

A. Oh, yes; it is permitted.

Q. What was the kind of polariscope that was used generally years ago?

A. The instrument in use some time ago was known as the tint or color instrument.

Q. You regard this present instrument an improvement over that?

A. I should regard it as far superior and safe in the hands of a man who has gained any considerable degree of accuracy in manipulation and it would give correct results. But the trouble about the color instrument is that you have to distinguish between delicate shades of color, consequently inaccuracy is introduced, because of the failure to distinguish between the colors. Many men are color blind without being aware of it.

Q. Was the color instrument used under the regulations of 1883?

A. I think it was; this instrument was generally used in the Government in connection with the sugar bounty law.

Q. Now, in making up all these standardizations that you have mentioned, have you made allowance for temperature?

A. That is allowed for in the value which we assign to the quartz plate. That saves the observer from being called upon to make computations.

Q. Is this method under these present regulations any more complicated under the regulations of 1883?

A. No; the labor of the polariscopists in the laboratory is just about the same, because the corrections are completed for him, he don't have any corrections to make; he takes the difference between his actual reading of the quartz plate and what it should read according to the table; that difference is applied to the reading
159 of the sugar, plus or minus, whether above or below according to the temperature.

Q. You are familiar with both of these instruments and the two methods of their use under the former regulations and that used by the private chemists?

A. Yes, sir.

Q. Will you state your opinion as an expert which you regard as the more accurate?

A. The polariscopes of course have nothing to do with the kind of flask that is used, that is immaterial; in no other respect, excepting in degree, does our method differ from that of the commercial chemists; in their operations they omit certain corrections which we take note of. The temperature correction we believe essential if you want your results within a quantity. And if the amount of temperature correction is too small to take note of in commercial transactions, that, of course, our office has nothing to do with.

Q. In your judgment, this present method prescribed in the regulations, insure greater accuracy in the testing of sugar?

A. They do.

Q. Can you make any statement in explanation of a statement made about refined sugar reading or apparently testing over 100?

A. I have frequently heard of that. That can occur in various ways. It may occur from the raffinose in the sugar. This scale, the one hundred point, is made for sucrose; it is not made for something else which has a different rotatory power from what sucrose

would have. Consequently, if raffinose, is present in the solution of sugar, the sugar has a higher reading power than sucrose. That might cause the sugar to read over 100. That would be due to the presence of raffinose. Also that scale is not made for raffinose, as I stated before. A scale to polarize raffinose would have to be on slightly different basis.——

Q. The other reason?

A. Well, other reasons may be assigned to accidental errors of the observer, the operator in the custom houses. There may be a difference of reading of .2 in the same sugar; that is, the same solution, they will vary as much as .2; that is the reading of the same solution at different times.

By Judge SOMERVILLE:

Q. Two skilled operators may differ?

A. In a large number of readings, they take the mean. That inaccuracy of reading due to error of the observer, might account for the sugar reading above 100, and also through inaccuracy in the process; for instance, if the flask was not filled exactly to the proper mark, or, if too little water was put in the flask, that could make the solution too concentrated, that would polarize higher. Again, in weighing out the sugar; that again, would produce too great concentration if too much sugar was put in and be read
160 higher. Barring accidents of that kind, a solution of pure sugar, which did not contain raffinose, of course would not polarize over 100.

By Mr. GIBSON:

Q. Will you state whether or not you have made any investigations throughout the country in regard to the practical workings of this system in testing sugars by the polariscope, under the law of 1897?

A. I did. I was a member of the commission that in last April or May visited the ports of New York, Boston and Philadelphia, composed of Doctor Wiley, Doctor Crampton and myself, and examined into the workings——

Q. State what occurred.

Objected to by protestant's counsel.

A. The results of the investigations was that we found on the average the results attained in the custom houses was in practical accord; sometimes would be a little above, sometimes below, but on the average the results were practically those attained by the commission. I wish to say that the commission decided to use the Mohr flask instead of the true cubic centimetre. The flask, however, was carefully tested at our office; and throughout the investigations we used the Mohr flask and to some little extent also the true flask. Of course the methods otherwise were the same as those prescribed by the new regulations of 1897. And we had much finer instruments; we had one belonging to Doctor Wiley. It was simply a more refined instrument and better standardized. We took all the

precautions possible so our results might be considered as standards to compare with the operations at custom houses.

Q. Will you tell how the results obtained by you three experts compared with those made in the custom houses?

A. As I have stated on the average, the results were very close; but as I said, there were necessarily some variations, that of course was to be expected; sometimes ours were higher than the Government chemists, sometimes lower on a particular sample, but on the average, the results were very concordant. We tested from the same samples that the custom house chemists used and were furnished to us without their knowledge. We were furnished with samples as nearly identical as possible as those which the chemists of the port operated upon.

By Judge SOMERVILLE:

Q. The tests were contemporaneous?

A. Yes, made on the same day; one part of the sample was sent to the chemist in the laboratory and the other sent to us. The chemist in the laboratory didn't know that we were making tests in connection with them at all.

161 By Mr. GIBSON:

Q. What were your observations of the general workings and tests of sugars by these new regulations?

A. Our conclusion was that they were very satisfactory. The agreement between exchange samples of the different ports has been testified to by others and it has been very satisfactory; the disagreement I believe is within one-tenth of a degree.

By Judge SOMERVILLE:

Q. Were the tests made at that time by the chemists at the different ports, made under the regulations of 1897 under which you acted?

A. Yes, sir.

By Mr. GIBSON:

Q. Did you have interviews with the chemists who were testing for the sugar buyers and sugar sellers, during this time?

A. Yes, at New York, we had consultations with a number of trade chemists.

Q. Anywhere else?

A. Also at Philadelphia and Boston—I was not at Boston; I was at the other two ports.

Q. Will you please state what the subject of general consideration was between these two bodies.

Protestant's counsel objects to question; objection sustained.

Q. Did you find from your observations that there was any greater degree of accuracy in testing sugars under these present regulations than prevailed under the former regulations?

A. A much greater degree of correctness and accuracy than under former regulations. The discrepancies under the former regulations

mounted to as much as five or six tenths. I don't know this of my own knowledge, however; I got it from Treasury officials.

Q. Are these regulations such in the way of application that an ordinary custom house official in testing sugars could apply them?

A. The new regulations are very simple. They don't have to go into the correction methods; the corrections have been made by the weights and measures office.

Q. Did you explain at these conferences to these gentlemen who were private chemists of sugar refineries, what you have said here about these sugar regulations?

A. I did. There was some opposition at first before the matter was understood; but after the matter was explained to those gentlemen——

Objected to.

Judge SOMERVILLE: We will rule that out.

162 By Mr. TINGLE:

Q. Doctor, can you state anything more than you have in regard to the general effects of the polariscopic tests of sugar with respect to the variation of temperature?

A. Variation of temperature affect- the polarizations of sugar, and if precise results are required, it is my opinion, that the temperature correction must be applied. It is simply a question of more accuracy of the test of sugar. If the test is wanted only within a certain degree, then the temperature might be ignored, not otherwise.

Q. In standardizing these various instruments, the flasks which contain the solutions of sugar, do you examine and test those in your office?

A. The office of weights and measures has made demonstrations of the amount of the effect of temperature on the polarizations of sugar. Doctor Wiley has also made demonstrations, which was submitted yesterday, and the results are in very close harmony. Doctor Wiley's test was .031; the weights and measures test was .029 and Prof. Andrews' test I think was .027; those three results agree very closely. The temperature correction which we apply includes both the temperature on the solution of the sugar, also on the quartz plate——

By Mr. GIBSON:

Q. That is included in the schedule that you have supplied to each office?

A. That is corrected in the table of values of the quartz plate which we furnish each operator.

By Mr. TINGLE:

Q. You have testified that you found a smaller number of discrepancies between the tests made by the Government officials under the regulations of 1897, than before; in making that statement did you mean to compare those tests with the tests that occurred in 1890, or just previous?

A. Both; I made the statement that those early years, tests made

than, I only had knowledge of from the officials of the Treasury Department; I had no personal knowledge of them; but I have seen the reports of disagreement or agreement between the exchange samples of the different ports, just prior and since the new regulations went into effect, from time to time. I have seen the reports as they come in; and they have shown progressive improvement as the operators became more familiar with the method. I was shown the official document and have no doubt it was correct.

Q. You stated that the operation of polarizing sugar under the new regulations is no more complicated than those in use previously, didn't you?

A. Not for the polariscopist; they are not if he uses our tables, he has nothing to do but simply to glance at that and take out his value of the sugar and make his corrections.

163 Q. Are not the extra reading of the thermometer and the quartz plate calculations and additions not called for in the commercial method?

A. No, sir.

Q. Do they not call for additional work?

A. No; because when you omit the quartz plate then the observer would have to be sure about the adjustment of the zero point of the instrument. If that point varies then all his polarizations will be out by that quantity; but the use of the quartz plate guards against that and he don't have to correct errors that he would be called upon to correct if he did not use the quartz plate in checking the position of the zero point and see that it does not move.

Q. Isn't this work required to be done—isn't it required to be done for each observation made by the operator?

A. The reading of the quartz plate, he knows the value of his quartz plate——

Q. Supposing the temperature changes?

A. You know the temperature at which your solution is made up; that temperature must be the same in both operations in reading and in making up the solution. The effect of the temperature on the quartz plate is insignificant.

Q. Do you know the optical value of quartz is increased by the rise of temperature?

A. The rotatory value of the quartz plate is directly proportional to the thickness of the plate, consequently the higher the temperature extends the thickness of the plate, consequently has a greater rotatory power.

Q. May it be increased by pressure also?

A. The rotatory power may be affected by pressure, it may be diminished, it may be destroyed completely, for that reason the quartz should be very carefully mounted; because if it strained it is no longer reliable, and care should be taken not to have any strain attached, for if it strained it is no longer reliable.

Q. An increase of pressure of a quartz plate may increase its rotatory value?

A. An increase of pressure? I understand you mean a strain; oh, well, the pressure, that is a small quantity, however, it is a

small factor; it would be inappreciable in a plate that we use in a polariscope.

Q. You don't know how great an effect?

A. I could not state just now.

Q. Never experimented in that direction?

A. No, not in that direction, never experimented.

Q. Might it not be possible that a quartz plate standardized by the Coast and Geodetic Survey, and having an optical value fixed at 17.5 centigrade—might not that same quartz plate change in its rotatory value or power, by means of pressure?

A. No; it might in consequence of a strain, or accident
164 or fall; for example, a severe jar. For that reason I consider it desirable to have these things re-tested frequently.

Q. You think it is possible, then?

A. I have never known of a case, but recognize the fact that it is possible; it might occur.

Q. You claim that the only object of introducing this quartz plate in these regulations is for the correction of temperature?

A. Oh, no, indeed. If we ignore the temperature correction we would still use the quartz plate; but we avail ourselves of the quartz plate as a medium through — to apply the correction for temperature in assigning the sugar value of the plate. It is necessary if we didn't take notice of the temperature; it is a check on the constancy of the zero point. It is necessary for those reasons.

Q. Then, what is the object of using the sugar values?

A. Well, the sugar values are a convenience to the operator. It would be an inconvenience to him to establish the value of the plate on the sugar in circular disks and he would have to make computations.

Q. Is it not primarily and ultimately too for the influence which is supposed to be exerted on the sugar solution?

A. No, it is only one; the temperature correction could be applied without applying it to the quartz plate.

Q. What is the object in these regulations of furnishing these tables of sugar values?

A. It is simply incidental that that was introduced, the table of values.

Q. The object is for temperature correction?

A. It is one object. If we ignored the temperature we would still use the quartz plate; it would still have a sugar value. The quartz plate is necessary to control the reading of the instrument and prevent gross errors.

Q. The chief object of introducing these so-called sugar values is to correct the temperature, to enable the operator to correct for the temperature?

A. It is one object; these sugar values would still be used and the quartz plate would still be used. When you buy a quartz plate the maker has a value marked on it, for instance, 99.5 or whatever it may be. We are not the ones who have introduced sugar values. They have always been used, they would be recognized under those

names. In our system we have used the quartz plate and for the convenience of the operators we have given a table of sugar values.

Q. They are then to be used by the operator for ascertaining the temperature?

A. Well, of course he gets his temperature from the thermometer and he makes his corrections from the table.

Q. When you state that the quartz plates are used, and the
165 sugar values are used, you mean that they are used for the purpose of standardizing the instruments, do you not?

A. You may express it that way, yes, that it can be used for that purpose.

Q. In addition you have introduced these tables of values to enable the operator to make proper corrections for the increase temperature after consulting his thermometer?

A. If we are not using temperatures the quartz plate would simply have one sugar value the same as the sugar solution that would have a value at 17.5. In this table we give what its corresponding sugar value will be at every degree from ten to 33 degrees centigrade. When the observer applies his quartz plate, supposing it reads 100, then he looks at the table to find that the value of that plate at the temperature of observation is 99.8 and there is 2/10 of a degree which is to be applied.

Q. Is not this system of sugar values introduced to correct the decrease of the sugar solution—rotatory power of the solution, which it is supposed to have undergone, on account of the increase of temperature?

A. Certainly.

Q. You heard the testimony in regard to the experiments made by Doctor Weichmann, and these other gentlemen, in testing chemically pure sugar?

A. I did.

Q. Can you give an opinion as an expert as to how those results were obtained as to the excess above 100?

A. Well, to do that I would have to know all the details and the method in which they carried out their operations, whether they thoroughly understood in all respects what we mean.

Q. The difference as to accuracy between the commercial method of testing and the method which has been prescribed by the Treasury under the new regulations may be ascribed solely to this correction for temperature?

A. Well, I think that is the main difference. There may be other prevailing conditions among the trade chemists. The trade chemists may have differed in some slight matter of detail in carrying out the regulations.

Q. That is the fundamental difference?

A. Yes, sir.

Q. Do you know anything about raffinose from personal knowledge of the subject?

A. I don't, except by reading. I never experimented with raffinose as a chemist never actually analyzed sugar in a chemical way.

Q. In polarizing sugars; did you ever polarize a sample of pure sugar, chemically pure, that was found to be above 100?

A. Only twice; then the excess over 100, I think in one case, 100.10 and in the other case 100.05, but we didn't ascertain
166 what the cause was, there might have been a slight presence of raffinose, that I could not tell.

Q. You are not prepared to say that?

A. It might have been an error in observing but as there were three of us working together and each getting the same result it seemed less probable that it was an error of the observer.

By Mr. GIBSON:

Q. In speaking of the quartz plate, Doctor, please state whether it would also give the correct reading for the difference in size of the flask used than for which the instrument is standardized?

A. This correction is also applied in the value of the quartz plate. That is very important and I am glad you called my attention to it. That must not be neglected. The difference between the flasks amount to .7. The flasks furnished by the weights and measures office are true cubic centimetre flasks, holding 26.048 grammes of sugar in 100 true cubic centimetres of solution, 17.5 C. The Government flasks are graduated to contain 100.06 true cubic centimetres, the excess of .06 being the correction by weighing the same in air against brass weights and to avoid the necessity of reducing the sugar to vacuo. The difference between the Mohr flask, 100.23, and our flask, 100.06, is .17 of a cubic centimetre. This difference if not compensated would produce a difference in the polarizations. To save the operaters the trouble to make the correction of that .17 the correction is applied in the quartz plate.

Q. Do you standardize all these instruments for chemists generally in the country?

A. Yes the weights and measures office will standardize such apparatus for people who wish it.

Q. The thermometer that is used in connection with the polariscope is also standardized by your office?

A. Yes, sir.

WILLIAM C. JACOBS, called as a witness for the Government, having been duly sworn, testified as follows:

By Mr. GIBSON:

Q. What is your occupation?

A. Supervision of the examination of sugars, port of New York.

Q. How long have you occupied such position?

A. About six years.

Q. State what the general character of your duties are as such officer?

A. I have entire charge of the sampling of the goods and also——

Q. You mean sugars?

A. Of the sugars and also making accepted tests on the sugars and returning the same for duty.

167 Q. State whether or not you observe the regulations of 1897 in the sampling and testing of sugars at this port?

A. We do.

Mr. TINGLE: He don't know anything about testing sugars.

Mr. GIBSON: He stated that he samples sugars.

(WITNESS:) We do.

Q. Do you have any supervision of the testing of sugars?

A. I have nothing to do with the chemical portion of it.

Q. Do you have any knowledge of the tests made by the buyers and sellers of sugars that are imported?

A. Considerable.

Q. Do you see the tests or know of them?

A. In a great many instances.

Q. Do you know whether as a rule the tests made by the chemists and buyer and seller agree?

Objected to.

Q. Do you know whether the buyer and seller make tests of sugar?

A. They do.

Q. Do you ever see those tests?

A. When the chemist requires those.

Q. Do they have different chemists?

A. The buyer has one and the seller another.

Q. What is the method of sampling, if you know, between the buyer and seller?

A. They are supposed to sample in measure I understand, practically the very package of sugar, and the sugars are mixed thoroughly, two sometimes made from each one; one taken by the buyer and one is taken by the seller who represents him at the vessel. They are sent to the chemist whom the house employs; one part to the buyer and one part to the seller, then they make their return to the people who employ them, and the average of the two is taken.

By Judge SOMERVILLE:

Q. Each one make a polariscopic test?

A. Yes, sir.

By Mr. GIBSON:

Q. Do you know whether or not they generally differ?

A. They differ in perhaps nine-tenths of the cases.

Q. Within what limits do their tests differ?

A. Range 1/10 up to a degree.

Q. Have you made any record of the tests taken in a number of cases of sugar importations polarized under these regulations?

A. Yes, sir.

168 Q. Made by the Government and then the tests upon which the buyer and the seller dispose of their sugar, or the settlement test?

A. Yes, sir.

Objected to, until Mr. Jacobs has shown how he came by the information.

Judge SOMERVILLE: I understood him to say that this information was acquired in the discharge of his duties in the office.

Q. You are furnished—please state, Mr. Jacobs, with the polariscopic tests as made by the Government examiner in the appraisers' office at this port?

A. Yes, sir.

Q. Furnished with them all?

A. Yes, sir.

Q. You send samples to the chemist and they return you a certificate of the test of the sugar; do you know of the settlement tests between buyer and seller of the same sugars?

A. Yes, sir.

Q. Do they furnish you with a record?

A. Upon request, with the exception of the American Sugar Refining Co., who refuse to do so.

Q. All furnish you with a settlement test except those?

A. Yes, sir.

Q. Have you made a compilation in a number of cases of the test—will you please state in what number of cases you have made a summary of the polariscopic test as made by the Government in your office, and the same sugar, same importation of sugar, where the settlement tests have been furnished by the buyers and sellers?

A. Yes, sir.

Q. How many?

A. About 1200 of which 63 per cent. of these figures would be—63 per cent. of the Government was high and about 37 per cent. of the Government was low.

Q. In 37 per cent. of these 1200 cases the settlement test of the buyer and seller was higher than the Government test?

A. They were, also the Government test was lower.

Q. They were higher?

A. Yes.

Q. And the sugar was bought and sold on a higher test than that which was made by the Government?

A. Yes, sir.

By Judge SOMERVILLE:

Q. In the trade what is the basis so far as the test is concerned, that is adopted in the trade; is there such a thing as settlement test?

A. As an agreement between the buyer and seller they have two tests.

Q. Is that a compromise between the two?

169 A. It is a compromise; no test at all.

Q. How long has that practice prevailed here in the trade?

A. As far as I can remember.

By Mr. GIBSON:

Q. For how many years?

A. I guess that has been since the test has been adopted as a measure.

Q. How many years, ten?

A. Yes, at least.

By General Appraiser TICHENOR:

Q. You understand that has been a rule ever since the polariscope has been used in the sugar business?

A. Yes, sir.

By Mr. TINGLE:

Q. Is that what you call the commercial test, Mr. Jacobs, the test arrived at between the buyer and seller?

A. That is the settlement test upon which the sugars are bought and sold.

Q. Is that known as the test, recognized in the trade as the commercial test?

A. I cannot answer.

Q. Isn't that system of compromise tests be*be*tween two tests used also in the Government laboratory, don't the regulations prescribe that?

A. Let me think for a moment.

Q. Is not the same thing true as to reaching a test which is a compromise between two in the Government business as well as among the trade, under existing regulations and under the previous regulations?

A. I think the counsel is right. The method is the same in the Government as in the trade.

Q. You spoke of the tests made by the trade from samples taken by them and the tests made by the Government from samples taken by the Government under your direction and the disagreement between those tests as shown by the table you have submitted; it is possible that tests made from different samples taken in that way would agree within a small percentage?

A. The percentage was very large; the differences are large, not small differences.

Q. Could not those differences be attributed to the difference in the samples rather than a difference in the tests?

Mr. GIBSON: I object to that; this witness has not been called as a chemist.

Judge SOMERVILLE: I don't think he is competent.

Mr. TINGLE: Your honor, I want to prove this: That the method of taking samples by the merchants is entirely different from
170 the methods of taking samples by the Government; consequently a comparison of the tests of the samples taken by the Government and the samples taken by the merchants is not a fair comparison.

Judge SOMERVILLE: That is a question the board is constituted to decide.

By Mr. TINGLE:

Q. Mr. Jacobs, will you please state the difference between the methods of taking samples by the Government and by the importers?

A. We take smaller percentages than the importers. Outside of that there is a very little difference.

Q. What percentage do you take?

A. We follow the regulations.

Q. What percentage do you take? I want you to state what percentage you take for instance of bag sugar?

A. Five per cent., unless we see fit to take more.

Q. What percentage of bag sugar do the merchants take?

A. According to what they are.

Q. Supposing it is Brazilian sugar?

A. Five, six, seven or eight per cent.

Q. No more than 5, 6, 8 or 10 per cent.?

A. Barring exceptions.

Q. How about Cuban sugars?

A. Eight per cent.

Q. Centrifugal?

A. Yes, about the same.

Q. What of Muscavado from Cuba?

A. Don't come from Cuba.

Q. Molasses or sugars?

A. About the same as the others.

Q. What percentage do you take?

A. Five per cent. unless we wish to take more.

Q. You sample the same box that the merchants sample?

A. Sample part of them, I suppose actually our percentage comes from what they have drawn.

Q. You sample then the same package they sample?

A. Exactly.

Q. You don't always sample the same package they sample?

A. Except in barring the exceptions always. Those few sugars we do not take every package. Manilla and beet root sugars they only take 5 or 6 per cent., ten per cent., the same as we do.

By General Appraiser TICHENOR:

Q. Mr. Jacobs, would or would not, in your judgment, the difference in the methods of taking samples by the Government and the merchants, lead to a difference in the polariscopic test of the sugar?

A. It might unquestionably.

171 By General Appraiser WILKINSON:

Q. Under the act of 1894, you received settlement tests in the case of almost every importer, did you as a rule?

A. Yes, sir, they were forced on us.

Q. Now as a mater of fact, recently, do the settlement tests run higher or lower than the Government tests?

A. I should judge about the same percentage as I have given.

Q. About 67 per cent. I believe you said run higher, that is the Government tests?

A. About that.

Q. In every instance I believe you said, under the old act you had their settlement tests for comparison?

A. Under the act of 1894, yes, we always had the settlement tests.

(Judge SOMERVILLE:)

Q. That was done for purposes of re-appraisement on the value?

A. At the start, yes; but afterwards, on all appraisements.

Q. Not for purposes of classification?

A. No, purposes of value.

Counsel for protestant states that he desires to recall Doctor Weichmann for the purpose of having him make a statement.

F. G. WEICHMANN recalled:

By Mr. TINGLE:

Q. Doctor, did you attend the third International Congress of Applied Chemistry which met in Vienna last summer?

A. Last summer.

Q. In what capacity?

A. I did not consider it necessary to unfurl my scientific pedigree, but, as you ask, I will state that I did attend that congress as a member of the American committee, as the representative of the American Sugar Refining Company; and that when there I had the honor to be *of being* elected an honorary vice-president of the congress.

Q. You were a member of the international commission when Doctor Wiley read his paper?

A. I was at that time and am now.

Q. You participated in the discussion at which time Prof. Wiley read his paper on the influence of temperature on the sugar polarizations; did you hear Doctor Wiley's testimony?

A. I did.

Q. With respect to the experiments made by him with chemically pure sugar?

A. I did.

Q. Will you please state, if you please, how it is possible
172 that chemically pure sugar, tested by you under the regulation of 1897, tested over 100?

Mr. GIBSON: One moment, now; this witness has already given his testimony on that point.

A. The matter is exceedingly a simple one. When I examined the chemically pure sugar I took pains as I told you, to make the polarization from a solution at the same temperature at which it had been made up. Doctor Wiley testified that he did exactly the same thing. You will recall that he testified to the fact that an increase in temperature affects the optical value of the quartz plate and I have testified to the same thing. I have testified to the fact——

Mr. GIBSON: I ask that that all be stricken out.

Motion denied.

WITNESS: In Doctor Wiley's work, the tests were carried on in rooms which were kept at varying temperatures from 10, 20, 30 and 40 degrees C. As he testified, his solutions——

Mr. GIBSON: That is not a statement. He is rehearsing the evidence.

WITNESS: As he testified his solutions were made up at the respective temperatures at which he polarized them. Doctor Wiley and myself have both brought out very clearly the fact, and my testimony shows the fact that an increased pressure upon the quartz plate——

Mr. GIBSON: He is arguing the case now.

Board rules that the last two questions and answers thereto be stricken out.

By Mr. TINGLE:

Q. Is there any explanation to be offered for the differences between your tests and their tests, which have been spoken of here by Doctor Wiley and others, except the difference of temperature?

A. None whatever.

Government counsel objects.

Q. Is there any reason for the differences between your tests and those made by Doctor Wiley, except the difference in temperature, as they affect the quartz plate and the solution?

A. There is not.

Q. Will you explain the methods by which you made your tests?

Mr. GIBSON: One moment. This witness explained those methods yesterday (the day before) upon direct-examination. If he
173 has made any error in the statements made yesterday (the day before) he can correct that error.

Question withdrawn.

By Mr. TINGLE:

Q. Do you desire to make any explanation of your testimony as to the way in which you made those tests?

Government counsel objects; objection overruled.

A. I am willing to stand by my testimony as given yesterday (day before).

By Judge SOMERVILLE:

Q. How do you explain the variation in results as testified to by Doctor Wiley and yours which you say are correct?

Mr. GIBSON: One moment——

Judge SOMERVILLE: You cannot object to a question put by the board.

A. The difference lies just here, gentlemen: In making my tests, in preparing the solutions and polarizing them at the temperature

at which they were prepared (the temperature of the instruments remaining throughout essentially the same) by securing that fact, I obviated any influence which a change of temperature, and in consequence also a possible change of pressure might exert upon the rotatory power of the quartz wedges of my instrument. I did this advisedly and purposely to eliminate this disturbing influence. The result of my tests were, therefore, directly illustrative of the influence which a change in temperature must exert on the sugar solution, when it is prepared and read at the same temperature at which it is prepared, and when these tests are executed at different parts of the temperature scale.

Mr. GIBSON: I ask that this lecture or address as made be stricken out by the board because he testified to the same thing yesterday (day before).

Judge SOMERVILLE: We overrule your motion.

By General Appraiser WILKINSON:

Q. Wherein, then, does the difference lie between the tests you made and those made by Doctor Wiley?

A. An increase of pressure will increase the rotatory power of the quartz. An increase in the rotatory power of the quartz wedge brings with it of necessity, a lowering of the scale reading. An apparent decrease in the rotatory value of a solution observed in a polariscope, the quartz wedge of which is under increasing strain with increasing temperature, may, therefore, be perfectly explained by this cause.

174 By Mr. TINGLE:

Q. Will you state, if you please, whether in your experience in testing sugar at this port, you have ever found raffinose in the sugar you tested?

A. I have——

Mr. GIBSON: One moment; he has testified to that already.

Judge SOMERVILLE: Not on that point.

A. I have in raw sugars. Raffinose occur in the low products manufactured from beet especially. They are not frequent in the highest grades of sugar but do occur in the lower grades of certain kinds of sugars.

Q. Then, in the sugar solutions which you have been called upon to test here,—pure refined sugar,—chemically pure, could there be any raffinose therein?

Objected to; objection overruled.

A. In my opinion, there could not be, certainly in the higher grades.

Q. Would you have been able to discover the presence of raffinose in those,—can you detect by analysis the presence of raffinose?

A. I think I could if it were present.

Mr. GIBSON: I ask that this case be continued and that Doctor Wiley be recalled in regard to the matters that have been raised

here,—to testify about raffinose. I don't know how important it may be. This is the testimony on one side.

Judge SOMERVILLE: We must close this case to-day.

Mr. GIBSON: I ask that the board continue this case so that Doctor Wiley may be further examined and to controvert the statements made by Doctor Weichmann.

Motion denied.

Testimony closed.

Counsel allowed thirty days to file briefs.

175 EXHIBIT A.

34769 F.

DEC. 15, 1898.

Circular.

Sampling and classification of imported sugars and molasses under the act of March 3, 1883, and allowances for damage thereon

1883.
Department No. 62.
Secretary's Office.

TREASURY DEPARTMENT,
OFFICE OF THE SECRETARY,
WASHINGTON, D. C., *May* 22, 1883.

To collectors of customs and others:

The following regulations for the sampling and classification of sugars and molasses under the provisions of the tariff act approved March 3, 1883, and for allowances for damage, are prescribed for the guidance of customs officers.

CHAS. J. FOLGER, *Secretary.*

Regulations.

Sampling.

1. In the treatment of sugars, under these regulations, great care will be taken by samplers and other appraising officers to prevent the drying out of the samples. The covers shall be placed upon the tin sample-boxes as soon as filled, the boxes thereafter to be placed in the wooden chests, and the chests closed and fastened with as little delay as possible. The preparation of the general samples on the wharf, and the mixing and preparation of the samples in the examination-room and the laboratory, shall be done with dispatch, and, as far as practicable, under conditions to prevent evaporation of moisture.

2. In regard to sugar in hogsheads, tierces, barrels, and boxes, the packages of each mark shall be numbered from one upwards, as dis-

charged from the vessel, or weighed, the numbers to be scored on the marked head of the package, and at the same time, a double cross-mark, thus, ‖ , shall be scored just above and to the right of the number, to designate the "sample" packages.

3. The packages so designated, unless sampled as dis-
176 charged, shall be placed in tiers on the wharf, with a space four feet six inches between them, the marked and numbered heads facing the said space, so as to be readily seen by the sampler.

4. The collector will be held solely responsible for the proper designation of sample packages, as above indicated, and when necessary, will require the same to be placed on the wharf as herein provided, in order to convenient sampling. These duties will be performed under the supervision of an inspector, or of a weighing officer; but in the latter case, the weighing shall commence as soon as a sufficient number of packages have been discharged to render it probable that the work may go on continuously until the cargo is completed.

5. The packages so designated for sampling will be indicated in the inspector's discharging-book, or in the weigher's dock-book, by the letter "S" opposite the number or weight of the package. In the case of resamples, as hereinafter provided, the letters "R S" shall be so placed.

6. In regard to sugar in hogsheads and other packages, as above designated, 25 per cent. of each mark shall be sampled, unless the mark contain ten or less packages, when 50 per cent. shall be sampled; and the collector shall indorse on the permit, for the guidance of the discharging inspector, and also on the invoice for the information of the appraiser as follows: "Sample 25 per cent. alternate even (or odd) numbers," "Sample 50 per cent. even (or odd) numbers," as the case may be, the collector varying the order, in his discretion, so as to prevent possible collusion.

7. The sample packages shall be selected in regular order as numbered, as for example, when 25 per cent. is to be sampled, Nos. 2, 6, 10, &c., or Nos. 1, 5, 9, &c., will be taken according as the alternate even or odd numbers are designated on the permit. When 50 per cent. is to be sampled Nos. 2, 4, 6, &c., or Nos. 1, 3, 5, &c., will be taken, according as the even or odd numbers are designated on the permit; but when there are broken or damaged packages, those numbers shall be selected which most nearly correspond with those designated on the permit. If 25 per cent. and not over 50 per cent. of any mark be damaged, then 50 per cent. of the sound packages shall be sampled. If over 50 per cent. be damaged, then all the sound packages shall be sampled.

8. When a resampling is desired, a request for the same must be presented in writing, within twenty-four hours after notice of the original classification has been given to the importer, and in all cases of resampling every package not before sampled must be sampled.

9. All sugar in packages, as stated, shall be sampled by putting

the trier directly through the center of the package from end to end, one trier full to constitute a sample.

10. The samples as drawn shall be placed in tin boxes, properly labelled as to number and mark for identification, and conveyed to the appraiser's department in chests securely locked, together
177 with a letter of transmittal from the examiner in charge of the district, as per form furnished by this department. In cases where, owing to the presence of broken or damaged packages, it is found impracticable to carry out the order of the collector on the permit, the fact shall be noted on the label, and also in the examiner's letter of transmittal.

11. In order to verify, if necessary, the Government work and secure a proper responsibility on the part of the officers, the aperture, after sampling, shall be closed with a red plug, as furnished by the department, which shall be left undisturbed until such time as the sample packages are released from the control of the customs officers as hereinafter provided.

12. Of sugar in baskets, not less than 10 per cent. shall be sampled, the short trier being used; but when, from the small number of packages embraced in any mark, or other reason, it shall, in the opinion of the examiner, be necessary, such further percentage shall be sampled as will afford a fair representation of the sugar embraced in the mark.

13. Of sugar in bags and ceroons, 5 per cent., and in mats 2½ per cent. of each mark shall be sampled, to secure which the sugar when discharged shall be separated by marks as far as possible.

14. The selection of the sample packages shall be made by the collector, as in the case of other sugars, when the cargo is discharged or weighed every twentieth draft in the case of bags and ceroons, and every fortieth in the case of mats being taken, care being observed to take no broken or damaged packages, and to maintain the same number of packages to the draft throughout the entire cargo.

15. The packages so selected shall be stenciled in large characters "U. S. Sample," in the presence of the inspector or weighing officer, and shall be placed lengthwise in single or double tiers, as may be most convenient, so that the stencil-marks as above may be readily seen by the sampler and the packages be easily accessible for sampling.

16. In the case of bags and ceroons, the sample shall be taken from the middle of the package, a round tin sample-box full to constitute the sample which shall be treated in all respects in the same manner as samples from hogsheads.

17. In the case of mats, general samples will be made upon the wharves, as heretofore, each mark being kept separate, and the samples will be duly secured and labelled in the large sample-boxes provided for the purpose.

18. In the sampling of mats and ceroons, and of Pernambuco and other such sugars in bags, the knife heretofore provided will be used, and in the sampling of centrifugals in bags, the short trier, care being exercised to take the sample fairly from the central contents

of the package, and in such manner that the samples in the case of mats shall be of uniform quantity.

178 19. When the packages for original sample are selected, and in order to secure more correct and satisfactory results in case a resample is desired, every alternate twentieth draft in the case of bags and ceroons, beginning with the tenth, and every alternate fortieth in the case of mats, beginning with the twentieth, shall be placed aside, as before described for the original sample, and marked in stencil "U. S. resample." The boring or cutting by merchants' samplers of packages designated for sample or resample, as herein provided, until after the Government samples have been taken, is strictly prohibited.

20. In regard to melada and other sugar products not before named, paying duty under the law by weight, the packages shall be numbered, scored, and placed by the collector the same in all respects as in the case of hogshead sugars, one package in every four being designated for sampling. The sampling shall be done under the personal supervision of an examiner, who shall take from each package, placed on end, and after the removal of the head, a fair representation of its contents, making up a general sample of each mark for transmission to the appraiser's office, as provided in the case of mat sugars.

21. In the case of molasses, at least one package in every four in the order placed for gauging, or 25 per cent. of each mark throughout the cargo, will be taken, the examining officer at the same time making careful inspections of the whole cargo, in order to satisfy himself whether the molasses is uniform in character or otherwise. If such inspection shall disclose any considerable variation in the quality of the packages of each mark, a larger percentage shall be sampled, as in the judgment of the examiner may be necessary in order to secure a fair representation of the cargo. If any package or packages invoiced as molasses shall, in the judgment of the examiner, have the appearance of sirup of cane-juice, a separate sample from each such package, properly labelled as to mark and character, shall be taken for further examination, as hereinafter provided.

22. The sample shall be taken as heretofore, care being observed to secure a fair representation of the contents of each package, and from general samples of each mark thoroughly mixed the sample-cans provided by the department shall be filled and placed in wooden chests, duly labelled, as in the case of sugars, for transmission to the appraiser's office.

23. At ports where a number of samplers are employed no one sampler shall be continued at any particular wharf or dock, or be engaged upon the cargoes of any one firm longer than one month; but each sampler shall complete the sampling of any cargo upon which he may then be engaged before being transferred.

24. It is important, in order to the successful operation of the triers, that they be kept clean and free from rust. Suitable cleaning and polishing materials will be duly supplied to the samplers,

179 who are hereby particularly instructed to take proper care of the implements.

25. The sampling shall be done, except as before specified, under the general supervision of an examiner, who shall be held responsible by the appraiser for the strict and impartial enforcement of these regulations.

26. Officers of customs of every grade, having duties in connection with the treatment for duty of imported sugars, are expected to co-operate, and to use the utmost care and circumspection in order to the proper selection, marking, and placing of the sample packages, so that the work of sampling and appraisement may be facilitated.

27. Section 2882 of the Revised Statutes provides that imported sugars which shall be removed from the wharf or place where put without the consent of the proper officer, and before the quality has been ascertained, shall be forfeited, and may be seized by any officer of the customs or inspection.

28. In pursuance of the authority therein contained, it is directed that the packages designated and placed for sampling, under these regulations, shall not be removed without the written consent of the collector, until forty-eight hours after the statement of their classification has been publicly posted, as provided in paragraph 50 herein. Sugar so removed may be seized, and proceedings taken for forfeiture, as required by the section of law named.

29. In order to the prompt execution of the foregoing instructions, appraisers will at once advice the department relative to the best means of securing speedy communication with the examining officers on the wharves, and the necessary measures will be taken for the frequent and expeditious transmission of samples from the wharves to the appraisers' stores.

Classification.

30. When the samples have reached the classification room in the appraiser's office, they shall be carefully compared with the Dutch standard, and if found to be not above No. 13, Dutch standard in color, they shall be subjected to a polariscopic test for duty as hereinafter provided.

31. All sugars above No. 13 Dutch standard in color, shall be examined and passed upon by two experts in the appraiser's office, and, in case of disagreement between them as to the degree of color of such sugar according to the Dutch standard, the appraiser, or some officer designated by him shall decide between them. In case of a resample the classification for duty shall be the average of the classification of the original, and the resample on the basis of the proportion of the mark represented by each sample.

32. The samples of sugar so classified shall be carefully preserved in glass bottles, labelled with the name of the importer, date
180 of importation, whence imported, name of vessel, classification, the mark, number and character of packages, and the names of the examiners. The bottles containing such samples shall be sent by the appraiser to the collector at the time the invoice is

returned, and shall be publicly exhibited at the custom house for at least one week thereafter.

33. Sugars not above No. 13, Dutch standard in color, shall be selected by the experts in the examining room according to marks, and from a general sample of each mark, thoroughly mixed, a round tin sample-box full, properly numbered, shall, with as little delay as possible be transmitted to the laboratory for polariscopic test. An additional sample, prepared in the same manner, shall be held in the examination-room until the final classification is determined.

34. In order to eliminate the possible error of observation, and to verify the results obtained, all such samples of sugar and its various products, as specified in the law, except molasses, shall be tested in duplicate. Should the results of the two separate tests of the sample agree within three tenths (3-10) of 1 per cent., the lower of the two shall be accepted as the test for classification.

35. Should the results not agree within three-tenths (3-10) of 1 per cent., a third test of the sample shall be made, and of the three tests so made the lower of the two most closely agreeing shall be accepted as the test for classification, provided the said last mentioned tests agree within three-tenths (3-10) of 1 per cent.; and provided further, that if one of the three tests so made be the average of the other two tests, and agree with the same within three-tenths (3-10) of one per cent., then such test shall be accepted as the test for classification.

36. When two of the three tests so made do not agree within three-tenths (3-10) of 1 per cent., a fourth test of the sample shall be made, which shall be subject to the same provisions as hereinbefore stated with reference to the preceding tests; but a divergence rendering such fourth test necessary should not occur.

37. When resamples are submitted for test, they shall be labelled with the regular serial number, and treated in all respects in the same manner as original samples. In such cases the test accepted for classification shall be the average of the test of the original and the resample, on the basis of the proportion of the mark represented by each sample.

38. With a view to securing uniform results in the testing of sugars at the several ports, one or more samples of sugar, of which the test in the dry substance has been made, shall, with a statement of such test, be forwarded monthly from each of the sugar-importing ports to the United States laboratory at the port of New York, for a comparison of tests, the result of which shall be regularly reported by the appraiser at New York to the department.

39. In the classification of molasses, when the result of the
181 first test is within one of fifty-six degrees, either above or below, the foregoing directions regarding the duplicate or triplicate test of sugars shall be followed.

40. Importations invoiced and entered as molasses, possessing in any degree the taste or smell or other characteristic of sirup of cane-juice, shall be subjected to chemical analysis, and determinations will be made of the percentage of water and the cane-sugar in the dry substance.

41. In the event of the polarization of the dry substance being above 75 per cent., the sample shall be held to be sirup of cane-juice, within the meaning of the tariff; but should the polarization of the dry substance not exceed 75 per cent., the sample shall be designated as molasses, unless there be other evidence of a conclusive character to warrant its designation as sirup of cane-juice.

42. It may here be stated as the view of the department that molasses, within the meaning of the tariff, is the liquid residuum drained or purged from sugar, and hence is the result of a process of manufacture which has for its chief object the formation of sugar; while, on the other hand, sirup of cane-juice is the juice of the cane highly concentrated, but not to the point of crystallization, and hence is the result of a process of manufacture having for its chief object the concentration of the juice to the point of preservation, but short of crystallization.

Estimation of Damage.

43. It is of the highest importance, in the estimation of damage to sugars, that the samples be properly drawn, and to this end the sampling shall, when practicable, include an examination of the vessel, and of the sugar during its discharge.

44. Both the sound and damaged portions of the cargo shall be carefully sampled, either by the damage examiner himself or under his personal supervision. In cases where the cargo consists of different varieties of sugars, such as certrifugals and muscovados, or of Manila sugars, known as "superiors" and "extra superiors," samples shall be taken of each variety, care being exercised that the samples so taken fairly represent the proportion and degree of damage of each grade in the different classes.

45. The estimation of damage to sugar will be based chiefly upon the results of chemical analysis, determinations being made of the percentages of cane-sugar and water in the manner provided in the instructions hereto appended.

46. From these results the polarization of the dry substance is obtained in both the sound and damaged samples, the difference between them representing the percentage of grape-sugar produced by fermentation. This difference is multiplied by two, (2) in accordance with the accepted principle that crystallization is retarded by grape-sugar to an extent equal to twice the amount present. To this product is added the excess of water found
182 in the damaged sample over the sound. Where contact with sea water is indisputable, there will be added to the above an amount not to exceed one and one-half (1½) per cent., varying in proportion to the amount of sea-water shown to be present, to compensate for the damage resulting from the deposit of sea-salts, the estimation being made on the basis of three parts salts in one hundred parts of sea-water. On the principle that salt prevents the crystallization of five times its weight of sugar, the amount thus found will be multiplied by five, (5).

47. The following example will serve to illustrate the method of reckoning after the different determinations have been made:

	Polarization.	Water.	Cane-sugar in dry substance.
Sound sample	95.10 per cent.	1.03 per cent.	96.08 per cent.
Damaged sample	91.50 per cent.	3.47 per cent.	94.78 per cent.

Difference in water, 2.44; difference in dry substance, 1.30.

Difference in water	2.44 per cent.
Difference in dry substance 1.30 by 2	2.60 per cent.
Amount of salts in 2.44 per cent. sea-water, .073 by 5.	.36 per cent.
Total intrinsic damage	5.40 per cent.

48. Allowances for "commercial damage" as such will not be made; but in the case of certain low-grade sugars, particularly of malt sugars from the East Indies, and of South American sugars in bags, which by the action of sea-water have been materially degraded in color, an allowance not to exceed five (5) per cent. may be made in addition to the allowance for intrinsic damage, as ascertained by chemical analysis.

49. In the estimation of damage to molasses the same principles apply, and the same course will be pursued as prescribed in the case of damage to sugar.

Statement and Notice of Classifications.

50. A tabulated statement of the classification of all importations of sugar and molasses, and of damage allowances, when made, shall be prepared at the close of business each day, upon forms furnished by the department, which, on the following morning, shall be conspicuously posted at the custom-house, or such place as the department may designate, for the information of the trade. At the same time written notice of the classification of his sugars shall be mailed to the importer, for his personal information.

183 *Instruction in the Use of the Polariscope.*

The following instructions in regard to the use of the polariscope in the testing of sugar and molasses, and the adjustment and care of the instrument, prepared and revised by Mr. Edward Sherer, chemist in the United States appraisers' office at New York, are appended for the information of appraising officers:

Directions for Testing Sugar by the Polariscope.

1. Mix the sample thoroughly and uniformly, crushing all lumps.

2. Weigh accurately, in the German siler dish provided for the purpose, 13.024 grams of the sample to be tested. Should the counterpoise not exactly balance the dish, small pieces of tin foil should be used. Care should be taken to accurately balance the dish before each weighing. Wash the sugar from the dish into a 50 c. c. flask with the aid of the washing-bottle, taking care that every particle of sugar is transferred to the flask, which should be not more than two thirds full when all is in. Wash down into the flask any grains that may adhere to the neck, using as little water as possible for this purpose. Take the flask by the neck, between the thumb and forefinger, and shake gently in one direction, causing the liquid to rotate in the flask till the sugar is in solution. The body of the flask should not be handled, as the heat of the hand will increase the temperature of the solution.

To determine when the sugar is in solution, hold the flask to the light and shake gently, when any crystals of sugar not dissolved will be readily detected at the bottom of the flask. Wash the neck of the flask again with the washing-bottle, to carry down any particles that may have been spattered up in the process of shaking.

3. Subacetate of lead is now to be added to the solution in the flask, drop by drop, till no further precipitate is formed. When sufficient has been added, the lead solution will settle clear at the bottom of the flask. From twenty to sixty drops, or from one to three cubic centimetres will answer for sugars. For molasses, five cubic centimetres is the maximum amount needed. An excess of the lead solution is to be avoided, as it causes turbidity in the solution by reason of the precipitation of fine particles of carbonate of lead which pass through the filter and render the solution opaque when placed in the observation-tube. The lead solution is most conveniently added by means of a Berlin flask and siphon tube, with rubber connection and pinch-cock. Care should be taken to keep the air from the flask, by means of a glass rod in the end of a rubber tube when not in use, as the access of air causes the precipitation of carbonate of lead.

4. The flask should now be filled to within half an inch of the neck with the washing-bottle. A drop of ether added from a small bottle will remove all air-bubbles, that would otherwise interfere with the accurate filling of the flask to the mark. After the addition of the ether, fill the flask to the mark by adding water, drop by drop, from a Berlin flask, with similar attachments as the flask used for the lead solution. The flask containing the sugar solution should be so held that the line will be on a level with the eye, and should be filled till the bottom of the curve at the surface of the liquid or meniscus is even with the line.

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5. Place the *the* thumb over the neck of the flask and shake well, and filter into a clean, dry cylinder jar, (glass.) Should the solution be dark in color, two or three small spoonfuls of pulverized

bone-black should be placed in the cylinder, and the solution well shaken and again filtered. The bone-black used for this purpose should be previously dried at a temperature of [illegible]° to 160° centigrade, and kept under a desiccator, as it readily absorbs moisture, and its use in a moist state would increase the volume of the solution and make the result of the test too low. Screw the cap, with rubber washer and glass plate, on one end of the observation-tube, taking care that the glass plate shall press lightly on the end of the tube; then pour the clear, light-colored solution into the tube till it slightly overruns the end. Slide the glass plate over the end, so as to avoid getting any bubbles of air under it, and screw on the cap.

6. Place the tube in the instrument and turn the thumb-screw underneath to the right or left till the colors are blended. By turning the screw at the right-hand side of the instrument the degree of light is regulated so as to obtain the shade at which the colors are plainest. All the shades can be obtained by turning this screw halfway round in both directions, and it should not be turned completely around in one direction, as this would be liable to get the instrument out of adjustment. When the colors are equalized, the percentage can be read from the scale by observing the position of the zero. The tenths are ascertained by counting the lines to the right of the zero on the upper or vernier scale till a line is found to make one uniform vertical line with a line on the lower scale. Repeated observations with variation of shade, by the use of the screw at the right, should be made before accepting the result as correct.

7. For determination of the percentage of water, weigh five grams of the sugar in one of the flat-bottomed porcelain dishes provided for the purpose, the exact weight of the dish having been previously noted. Place the dish in the water-bath and heat at the temperature of boiling-water for one hour. Heating for a longer period gives erroneous results. Cool under desiccator and weigh. The loss in weight represents the water in five grams of the sugar. The percentage of water is obtained by multiplying this amount by one hundred (100) and dividing the product by five, (5.) The dry substance is one hundred, (100,) less the percentage of water.

8. The percentage of cane-sugar in the dry substance is
185 obtained by multiplying the direct polarization by one hundred (100) and dividing the product by the dry substance.

Determinations of the percentage of water in samples of molasses and sirup of cane juice are made in the following manner:

The porcelain dish used for the estimation of water in sugar samples is filled to within one-quarter (¼) of the top with previously-dried fine sand; a small glass rod, with one end flattened, is placed in the dish, and the weight of the dish, sand, and rod together carefully noted. From one to two grams of the sample to be tested is then poured into the dish, and the weight of the whole contents again noted. The difference between the two weights is the weight of the sample taken for test. The contents of the dish are then intimately mixed by means of the glass rod, the dish being placed on a clean sheet of paper, to enable the operator to return to it any particles that may be spilled out in the process of mixing. When the

contents of the dish are mixed to the ordinary consistency of a muscovado sugar, the dish is placed, with entire contents of sand, rod, and sample, in the water-bath, and heated at a temperature of 100° C. for one hour. It is then cooled under the desiccator, and carefully weighed, and again heated for an hour, when, if no further loss in the weight is observed, the operation is finished.

The difference in weights before and after drying represents the water in the quantity of the sample taken. The percentage of water is obtained by multiplying this amount by one hundred (100) and dividing the product by the quantity taken.

In the case of sugars containing more than five (5) per cent. of water, a similar course is followed, for the reason that such sugars, if placed in the water-bath unmixed with sand, become incrusted with a coating of dried sugar, which prevents the evaporation of the moisture from the interior portions.

Of course the polarization under these instructions will be made upon sugars in the condition in which they arrive, and not upon the dry substance.

Method of Adjusting the Polariscope.

(Translation of a letter from Prof. Scheibler, accompanying polarization instrument.)

If the zero-point should stand for the eye of the analyst two-tenths of a degree to the left or the right, it then would not be advisable to alter its position; but in all the polarizations these tenths of a degree are to be respectively added to or subtracted from the reading.

If, however, the analyst desires to compensate the deviation of the zero-point according to the quality of color which suits his eye and to which he has adjusted the plane of polarization, or, in other words, to adjust the zero-point himself, there is for that purpose in the mahogany box a small adjusting key, T, which is to be put in the opening or key-hole which lies on the left hand of the telescope, on the immovable setting of the quartz prism; and then, while observing by means of the looking-glass, he moves the vernier to one side or the other until its zero-point precisely coincides with the zero-point on the scale, that is to say, until both zero-points, when seen through the mirror, form a uniform vertical line. Never, however, must the key be put on the four-sided rod which lies on the right side of and below the telescope, and least of all must be moved by turning, as thereby the entire optical organism would be thrown out of position, and a regulation of the apparatus would have to be made. With regard to the use of quartz plates which acompany the apparatus, an observation tube is to be taken that had best be one hundred (100) m. in length, (one-half tube). The cover-glasses are removed, and the quartz plate which is taken for testing the scale is fastened on one end of the same concentrically, by the aid of three separate drops of wax, by gentle pressure, so that it adheres. Then the capsule is loosely screwed on

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in such a way that it does not touch the quartz plate, still less press on it, for the rotatory power of the plate would be changed by the slightest pressure. The tube is then laid in the apparatus so that the end with the quartz plate lies next to the lamp, and the instrument is then adjusted to equality of color. The reading of the scale must then give the previously-determined value of the plate (under the consideration of the fact that the neutral or zero point of the same has not been previously adjusted by the analyst), otherwise the scale would be intact.

Every one of the four quartz plates is marked with its rotating power, so that it is recommended that care be taken not to confound them in removing from their wrappers.

I have to remark that quartz plates cannot be made under forty degrees, as they would be so thin that their rotatory power would be doubtful and variable.

A permanent register of the calssifications of sugars and molasses imported into the United States, subject to duty under the tariff of 1883, will be kept both by the Dutch standard of color and by the polariscopic test. All allowances for damage will be shown thereon.

A statement of the classifications of such merchandise, and of damage allowances thereon, will be posted for the information of the public. The forms will be substantially as printed below. Books and blanks will be furnished by the department on requisition therefor.

(Here follows statement of classification of sugar marked p. 185*a*.)

Statement of Classification of Sugar.

CUSTOM HOUSE, APPRAISER'S OFFICE,

May 16, 1883.

A.

Date of Entry.	Vessel.	Importer.	Where from	Amount.	Character of product.	Marks.	Color, D. S.	Laboratory No.	1.	2.	3.	4.	Test for classification.	Remarks.
May 5, 1883.	Niagara	S. & W. Welsh.	Havana.	310 hhds.	Centrifugal sugar.	Esperanza, W. O.	9.10	1	9. W	93.40	93	92.1	92	
May 10, 1883.	R. M. Herlen.	Galway. Casada.	Porto Rico.	43 Casks.	Molasses	Ponce, P. R. B. A.	.....	N	54.20	54.30	....	.....	54.20	

B.

Date of Entry.	Vessel.	Importer.	Where from.	Amount.	Character of product.	Marks.	Color, D. S.	Polariscopic test.	Remarks.
May 5, 1883....	Niagara	S. & W. Welsh	Havana.	310 hhds.	Centrifugal sugar.	Esperanza, W. O.	9.10	94.30	
				100 hhds.	Muscovado sugar.	Luisa, H. A.	8.9	93.80	
				260 hhds.	Molasses sugar.	San José, A.	6.7	90.10	
March 30, 1883.	W. H. Swift	R. B. Borland	Pernambuco.	2,000 bags	Muscovado sugar.	Selected Brutos, C. C.	*7.8	92.40	
April 30, 1883.	Hannah McLoon.	Moses Taylor & Co.	Saguala Grande.	98 hhds.	Molasses sugar.	San Jacinto, A. B.	6.7	84.10	Damage allowance, 5 per ct.
				100 hhds.	Muscovado sugar.	Candad, D.	50 hhds. 13.16	50 hhds. 96.40	
April 12, 1883.	Santiago.	Havemeyers & Elder.	Cienfuegos.	192 hhds.	Centrifugal sugar.	San José, H. E. O., 10–12.	97.40	.....	Resample.

——— ———, *Assistant Appraiser.*

187 EXHIBIT B.

34769, F, Dec. 15, 1898.

REGULATIONS.

GOVERNING THE

SAMPLING, CLASSIFICATION AND APPRAISEMENT

OF

IMPORTED SUGARS AND MOLASSES

UNDER THE

ACT OF AUGUST 28, 1894.

Washington:
Government Printing Office.
1895.

Treasury Department,
Document No. 1766.
Office of Secretary.
Division of Customs.

TREASURY DEPARTMENT,
OFFICE OF THE SECRETARY,
WASHINGTON, D. C., *May* 13, 1895.

To collectors and other officers of the customs:

The following regulations for the sampling and classification of sugars and molasses under the provisions of the tariff act of August 28, 1894, and for the polarization of sugars as an aid in determining their dutiable value, are prescribed for the guidance of customs officers.

CHARLES S. HAMLIN,
Acting Secretary.

Regulations.

Sampling.

Par. 1. In the treatment of sugars, under these regulations, great care shall be taken by samplers and appraising officers to prevent the drying out of the samples. The covers shall be placed upon the tin sample boxes as soon as filled, the boxes thereafter to be placed in the wooden chests, and the chests closed and fastened with as little delay as possible. The preparation of the samples in the ex-

amination room and laboratory shall be done with dispatch,
188 and, as far as practicable, under conditions to prevent evaporation of moisture.

Par. 2. In regard to sugar in hogsheads, tierces, barrels and boxes, the packages of each mark shall be numbered from one upward as discharged from the vessel, or weighed, the numbers to be scored on the marked head of the package, and at the same time a double cross mark, thus $\frac{11}{11}$ shall be scored just above and to the right of the number to designate the "sample" packages.

Par. 3. The packages so designated, unless sampled as discharged, shall be placed in tiers on the wharf, with a space 4 feet 6 inches between them, the marked and numbered heads facing the said space so as to be readily seen by the sampler.

Par. 4. The collector will be held solely responsible for the proper designation of sample packages, as above indicated, and when necessary will require the same to be placed on the wharf, as herein provided, in order to convenient sampling.

These duties will be performed under the direction of an inspector, or of a weighing officer.

Par. 5. The packages designated for sampling will be indicated in the inspector's discharging book, or in the weigher'r dock book, by the letter "S" opposite the number or weight of the package.

Par. 6. In regard to sugar in hogsheads and other packages, as above designated, 25 per cent. of each mark shall be sampled, unless the mark include ten or less packages, when 50 per cent. shall be sampled; and the collector shall indorse on the permit for the guidance of the discharging inspector or weighing officer, and also on the invoice for the information of the appraiser, as follows: "Sample 25 per cent. alternate even (or odd) numbers" "Sample 50 per cent. even (or odd) numbers," as the case may be, the collector varying the order in his discretion, so as to prevent possible collusion.

Par. 7. The sample packages shall be selected in the regular order as numbered, as for example, when 25 per cent. is to be sampled, numbers 2, 6, 10 etc., or numbers 1, 5, 9, etc., will be taken, according as the alternate even or odd numbers are designated on the permit. When 50 per cent. is to be sampled numbers 2, 4, 6, etc., or numbers 1, 3, 5, etc., will be taken, according as the even or odd numbers are designated on the permit.

Par. 8. All sugar in packages, as stated, shall be sampled by putting the long trier directly through the center of the package from end to end, one tin box full to constitute a sample.

Par. 9. The samples as drawn shall be placed in tin boxes of uniform size furnished by the department, properly labelled as to number and mark for identification, and conveyed to the appraiser's department in chests securely locked, together with a letter of transmittal from the examiner in charge of the district, as per
189 form furnished by this department. Every conveyance shall be in charge of a sworn officer of the Government provided by the collector.

Par. 10. Of sugars in baskets not less than 10 per cent. shall be sampled, the short trier being used, and every tenth basket shall be selected for sampling, in order as discharged; but when from the small number of packages embraced in any mark, or other reason, it shall, in the opinion of the examiner, be necessary, such further percentage shall be sampled as will afford a fair representation of the sugar embraced in the mark.

Par. 11. Of sugars in bags and cerroons, 5 per cent., and in mats 2½ per cent. of each mark shall be sampled, and such sugars shall, as far as possible, be so separated and discharged by marks that the drafts selected and set apart for sampling, in manner as hereinafter provided, shall properly represent the required percentage of each mark.

Par. 12. The selection of the sample packages shall be made by the inspector or weighing officer, when the cargo is discharged or weighed, as follows: Every twentieth draft in the case of bags and cerroons, and every fortieth draft in the case of mats shall be taken, care being observed to maintain the same number of packages to the draft throughout the entire cargo. In no case shall broken or damaged packages be selected for sampling.

Par. 13. The sample packages of bags, cerroons and mats shall be stenciled in large characters "U. S. sample." Such stenciling shall be done at the time of discharge, under the direction of an inspector, or of the weighing officer as the sugars are weighed. After stenciling, and when impracticable to sample at the vessel, the sample packages shall be at once laid out for sampling under the direction of an officer to be designated by the collector. Such packages shall be placed lengthwise in single or double tiers, as may be most convenient, so that the stencil marks may be readily seen by the sampler, and the packages be easily accessible for sampling. After the sample packages have been placed in condition for sampling, in manner as herein provided, care must be taken that such packages are kept separate and apart from all other sugars until after the sampling has been completed.

Par. 14. In the case of bags and cerroons the sample shall be taken from the middle of the package, a round tin sample box full to constitute the sample, which shall be treated in all respects in the same manner as samples from hogsheads.

Par. 15. In the case of mat sugars, general samples shall be made up on the wharves and placed in the square tin boxes furnished by the department, each mark being kept separate, and the samples shall be duly secured and labeled in the wooden chests provided for the purpose.

Par. 16. Marchant samplers are prohibited from boring or cutting into packages which have been set apart and marked for
190 sampling, as herein provided, until after the Government samples have been taken.

Par. 17. In the sampling of mats and cerroons, and of Pernambuco and other such sugars in bags, the knife will be used when the condition of the sugar renders the use of the short trier impracticable, and in the sampling of centrifugals in bags the short trier will be

used, care being exercised in all cases to take the samples fairly from the central contents of the package, and in such manner that the samples in the case of mats shall be of uniform quantity.

Par. 18. A larger percentage of any mark than hereinbefore provided shall be taken by the inspector or weighing officer when in the judgment of the examiner, such action is necessary to afford a fair representation of the mark. In such cases the additional packages so taken shall be placed in proper condition for sampling.

Par. 19. Sugars conveyed on lighters from place of original discharge before samples have been taken shall not be removed therefrom until notice is given the examiner in charge of the district of the time of their proposed removal.

Par. 20. The keys of the sample chests shall be in possession of the examiners in charge of districts, who, with the examiners at the appraiser's office, shall have sole custody of such keys.

Par. 21. At ports where a number of samplers are employed no one sampler shall be continued at any particular wharf or dock, or be engaged upon the cargoes of any one firm, longer than one month.

Par. 22. It is important, in order to the successful operation of the triers, that they be kept clean and free from rust. Suitable cleaning and polishing materials will be duly supplied to the samplers, who are hereby particularly instructed to take proper care of the implements. When sampling, and particularly when sampling gummy or sticky sugars, the sampler shall frequently and thoroughly clean his trier, which must in each case be dried with a towel or drying cloth before further use. *All sugars must be drawn with dry triers.* Any failure to observe these requirements shall be reported at once to the appraiser by the examiner in charge of the district, and such failure will be regarded as sufficient cause for removal.

Par. 23. In regard to malada and other sugar products not before mentioned, paying duty under the law, the packages shall be numbered, scored, and placed by the collector the same in all respects as in the case of hogshead sugars, one package in every ten (10) being designated for sampling. In order that correct samples may be taken, the heads of such sample packages shall be removed and replaced by the collector's employees after the sampling has been completed.

Par. 24. The sampling shall be done under the personal supervision of an examiner, who shall take from each package placed on end, and after removal of the head, a fair representation of its
191 contents, making up a general sample of each mark for transmission to the appraiser's office, as provided in the case of mat sugars.

Par. 25. In the case of molasses, at least one package in every ten in the order placed for gauging, or 10 per cent. of each mark throughout the cargo, will be taken, the examining officer at the same time making careful inspection of the whole cargo in order to satisfy himself whether the molasses is uniform in character or otherwise. If such inspection shall disclose any considerable variation in the quality of the packages of each mark, a larger per-

centage shall be sampled, as in the judgment of the examiner may be necessary, in order to secure a fair representation of the mark. If any package or packages invoiced as molasses shall, in the judgment of the examiner, have the appearance of sirup of cane juice, a separate sample from each package, properly labeled as to mark and character, shall be taken for further examination, as hereinafter provided.

Par. 26. The samples shall be taken as heretofore, care being observed to secure a fair representation of the contents of each package. General samples of the cargo shall be prepared by mixing thoroughly together the samples of each mark. From such several samples the cans provided by the department shall be filled and placed in wooden chests, duly labeled, as in the case of sugars, for transmission to the appraiser's office.

Par. 27. All officers of the customs having duties in connection with the treatment for duty of imported sugars are expected to coöperate and to use the utmost care and circumspection, in order to the proper selection, marking, and placing of the sample packages, so that the work of sampling and appraisement may be facilitated. The examiners shall be held responsible by the appraiser for the strict and impartial enforcement of these regulations, and to this end they shall be notified by the collector relative to the time of discharge or weighing of sugar cargoes in their respective districts.

Par. 28. Section 2882 of the Revised Statutes provides that imported sugars which shall be removed from the wharf or place where put without the consent of the proper officer, and before the quality has been ascertained, shall be forfeited, and may be seized by any officer of the customs or inspection.

Par. 29. In pursuance of the authority therein contained, it is directed that the packages designated and placed for sampling under these regulations shall not be removed, without the written consent of the collector, until after due notice of their classification, and appraisement has been furnished to the importer by the appraiser, in manner as hereinafter provided. Sugar so removed may be seized and proceedings taken for forfeiture, as required by the section of the law named.

Par. 30. In order to the prompt execution of the foregoing instructions, appraisers will keep the department advised relative to the best means of securing speedy communication with the
192 examining officers on the wharves, and the necessary measures will be taken for the frequent and expeditious transmission of samples from the wharves to the appraiser's stores.

Classifications.

Par. 31. When the samples have reached the classification room in the appraiser's office they shall be carefully compared with the Dutch standard, and if found to be above No. 16, Dutch standard, in color, they shall be examined and passed upon by two experts in the appraiser's office, and in case of disagreement between them as to the degree of color of such sugar according to the Dutch standard

the appraiser, or some officer designated by him, shall decide between them.

Par. 32. Sugars found to be above No. 16, Dutch standard, in color, shall be classified in color and rate of duty in the proportion which the sample packages as examined represent.

Par. 33. Sugars not above No. 16, Dutch standard, in color, shall be selected by the experts, in the examining room, according to marks, and from the samples of each mark, which must be thoroughly mixed together, a general sample will be prepared. From each general sample, a round tin sample box full shall be taken and labeled with its proper number, after which it shall, without delay, be transmitted to the laboratory for polariscopic test. In the transmission of samples from the examiner's room to the laboratory the samples shall be indicated by serial numbers, and the laboratory officers shall not be permitted to know the identity of the samples by having access to the key of the serial numbers, or by other means such as knowledge of distinguishing marks or memoranda. An additional sample of each mark shall be held in the examination room and such sample shall be used when in the judgment of the appraiser it may be necessary in order to verify the test of the sample first sent to the laboratory.

Par. 34. In order to eliminate the possible error of observation and to verify the results obtained, all such examples of sugar in its various products as specified in law, except molasses, shall be tested in duplicate. Should the results of the two separate tests of the sample agree within three-tenths (3/10) of 1 per cent., the lower of the two shall be reported as the true test of the sugar.

Par. 35. Should the results not agree within three-tenths (3/10) of 1 per cent., a third test of the sample shall be made, and of the three tests so made the lower of the two most closely agreeing shall be reported as the true test, provided the said last-mentioned tests agree within three-tenths of 1 per cent.; and provided further that if one of the tests so made agree within three-tenths (3/10) of 1 per cent. of the average of the other two tests then such test shall be accepted as the correct test. The accepted test may be used by the appraiser as an aid in determining the dutiable value of the sugar.

Par. 36. Samples of all importations of molasses shall be
193 selected by the experts in the examining room in the same manner as provided in the case of sugars submitted to the polariscopic test, and such samples shall be sent to the laboratory for test, a duplicate sample being held in the examining room for use as provided in paragraph 33 for the additional sample of sugar so refined.

Par. 37. When the result of the first test of a sample of molasses is within one of 40° or of 56°, either above or below, the regulations governing the testing of sugars shall be followed in the testing of such molasses, duplicate or triplicate tests being made.

Par. 38. All samples of molasses testing not above 40° by the polariscope shall be subjected to examination to determine the percentage of water contained therein.

Par. 39. Importations invoiced and entered as molasses, possessing

in any degree the taste or smell or other characteristics of sirup of cane juice, shall be subjected to chemical analysis, and determination will be made of the percentage of water and cane sugar in the dry substance.

Par. 40. In the event of the polarization of the dry substance being above 75 per cent., the sample shall be held to be sirup of cane juice within the meaning of the tariff, but should the polarization of the dry substance not exceed 75 per cent. the sample shall be designated as molasses, unless there be other evidence of a sufficiently conclusive character to warrant its designation as sirup of cane juice.

Par. 41. It may here be stated as the view of the department that molasses, within the meaning of the tariff, is the liquid residuum drained or purged from sugar, and hence is the result of a process of manufacture which has for its chief object the formation of sugar; while on the other hand sirup of cane juice is the juice of the cane highly concentrated, but not to the point of crystallization, and hence is the result of a process of manufacture having for its chief object the concentration of the juice to the point of preservation, but short of crystallization.

Par. 42. When an invoice of sugar or molasses has been passed, the appraiser shall at once mail a written notice to the importer informing him of the classification and test of his importation, and of the advance made in the value thereof, if any.

Par. 43. On the morning of the first official day after the return of invoices to the collector covering importations of sugar or molasses, a tabulated statement of all such invoices showing the polarization and appraised value, and particulars of importation, as per form annexed, shall be conspicuously posted at the appraiser's stores for the information of the trade.

Par. 44. At the close of business each week statements shall be prepared on the said form, covering representative importations of sugar and molasses from each port of shipment, which shall be exchanged between the ports of Boston, New York, Philadelphia, Baltimore, New Orleans and San Francisco. Such exchange sheets shall contain all details of information relating to the im-
194 portations covered thereby required in the tabulated statements, and when received shall be duly posted for trade information in all respects as provided for the tabulated statements in the preceding paragraph.

Par. 45. With a view of securing uniform results in the testing of sugar at the several ports, one or more samples of sugar of which the test in the dry substance has been made, shall, with a statement of such test, be forwarded monthly from each of the sugar importing ports to the *appraiser at the port of New York* for a comparison of tests, the results of which shall be regularly reported by the appraiser at New York to the department. *The results of the test made at the several ports and transmitted to the appraiser at New York shall not be communicated to the experts of the laboratory at New York prior to the report by the appraiser to the department of the results obtained in the New York laboratory.*

Par. 46. All unofficial persons, including importers and their agents, shall be excluded from the rooms of the appraiser's office wherein sugars are tested and examined.

Directions for testing sugar by the polariscope.

Par. 47. (1.) Mix the sample thoroughly and uniformly, crushing all lumps.

(2.) Weigh accurately, in the German silver dish provided for the purpose, 13.024 grams of the sample to be tested. Should the counterpoise not exactly balance the dish, small pieces of tin foil should be used. Care should be taken to accurately balance the dish before each weighing. Wash the sugar from the dish into a 50 c. c. flask with the aid of the washing bottle, taking care that every particle of sugar is transferred to the flask, which should not be more than two-thirds full when all is in. Wash down into the flask any grains that may adhere to the neck, using as little water as possible for this purpose. Take the flask by the neck, between the thumb and forefinger, and shake gently in one direction, causing the liquid to rotate in the flask till the sugar is in solution. The body of the flask should not be handled, as the heat of the hand will increase the temperature of the solution.

To determine when the sugar is in solution, hold the flask to the light and shake gently, when any crystals of sugar not dissolved will be readily detected at the bottom of the flask. Wash the neck of the flask again with a washing bottle to carry down any particles that may have been spattered up in the process of shaking.

(3.) Subacetate of lead is now to be added to the solution in the flask, drop by drop, till no further precipitate is formed. When sufficient has been added, the lead solution will settle clear at the bottom of the flask. From twenty to sixty drops, or from one to three cubic centimeters is the maximum amount needed. An excess of the lead solution is to be avoided, as it causes turbidity in the solution by reason of the precipitation of fine particles of car-
195 bonate of lead which pass through the filter and render the solution opaque when placed in the observation tube. The lead solution is most conveniently added by means of a Berlin flask and siphon tube, with rubber connection and pinch cock. Care should be taken to keep the air from the flask by means of a glass rod in the end of the rubber tube when not in use, as the access of air causes the precipitation of carbonate of lead.

(4.) The flask should now be filled to within half an inch of the neck with the washing bottle. A drop of ether added from a small bottle will remove all air bubbles, that would otherwise interfere with the accurate filling of the flask to the mark. After the addition of the ether, fill the flask to the mark by adding water, drop by drop, from a Berlin flask, with similar attachments as the flask used for the lead solution. The flask containing the sugar solution should be so held that the line will be on a level with the eye, and should be filled till the bottom of the curve at the surface of the liquid or meniscus is even with the line.

(5.) Place the thumb over the neck of the flask and shake well and filter into a clean, dry cylinder jar (glass). Should the solution be dark in color, two or three small spoonfuls of pulverized bone black should be placed in the cylinder and the solution well shaken and again filtered. The bone black used for this purpose should be previously dried at a temperature of 140° to 160° C., and kept under a desiccator, as it readily absorbs moisture, and its use in a moist state would increase the volume of the solution and make the result of the test too low. Screw the cap, with rubber washer and glass plate, on one end of the observation tube, taking care that the glass plate shall press lightly on the end of the tube; then pour the clear light-colored solution into the tube till it slightly overruns the end. Slide the glass plate over the end so as to avoid getting any bubbles of air under it, and screw on the cap.

(6.) Place the tube in the instrument and turn the thumb screw underneath to the right or left till the colors are blended. By turning the screw at the right-hand side of the instrument the degree of light is regulated so as to obtain the shade at which the colors are plainest. All the shades can be obtained by turning this screw halfway round in both directions, and it should not be turned completely around in one direction, as this would be liable to get the instrument out of adjustment. When the colors are equalized the percentage can be read from the scale by observing the position of the zero. The tenths are ascertained by counting the lines to the right of the zero on the upper or vernier scale till a line is found to make one uniform vertical line with a line on the lower scale. Repeated observations with variation of shade by the use of the screw at the right, should be made before accepting the result as correct.

(7.) For determination of the percentage of water weigh 5 grams of the sugar in one of the flat bottomed porcelain dishes provided for the purpose, the exact weight of the dish having been previously noted. Place the dish in the water bath and heat at the temperature of boiling water for one hour. Heating for a longer period gives erroneous results. Cool under desiccator and weigh. The loss in weight represents the water in 5 grams of the sugar. The percentage of water obtained by multiplying this amount be one hundred (100) and dividing the product by five (5). The dry substance is one hundred (100) less the percentage of water.

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(8.) The percentage of cane sugar in the dry substance is obtained by multiplying the direct polarization by one hundred (100) and dividing the product by the dry substance.

Determination of the percentage of water in samples of molasses and sirup of cane juice are made in the following manner:

The porcelain dish used for the estimation of water in sugar samples is filled to within one-quarter (¼) of the top with previously dried fine sand; a small glass rod, with one end flattened, is placed in the dish, and the weight of the dish, sand, and rod together carefully noted. From 1 to 2 grams of the sample to be tested is then poured into the dish, and the weight of the whole contents again noted. The difference between the two weights is the weight of the

sample taken for test. The contents of the dish are then intimately mixed by means of the glass rod, the dish being placed on a clean sheet of paper to enable the operator to return to it any particles that may be spilled out in the process of mixing. When the contents of the dish are mixed to the ordinary consistency of a muscavado sugar, the dish is placed, with entire contents of sand, rod, and sample, in the water bath, and heated at a temperature of 100° C. for one hour. It is then cooled under the desiccator and carefully weighed, and again heated for an hour, when, if no further loss in the weight is observed, the operation is finished.

The difference in weights before and after drying represents the water in the quantity of the sample taken. The percentage of water is obtained by multiplying this amount by one hundred (100) and dividing the products by the quantity taken.

In the case of sugars containing more than 5 per cent. of water, a similar course is followed, for the reason that such sugars, if placed in the water bath unmixed with sand, become incrusted with a coating of dried sugar, which prevents the evaporation of the moisture from the interior portions.

Of course the polarization under these instructions will be made upon sugars in the condition in which they arrive, and not upon the dry substance.

Method of Adjusting the Polariscope.

(Translation of a letter from Professor Scheibler accompanying polarization instrument.)

If the zero point should stand for the eye of the analyst two-tenths of a degree to the left or the right, it then would not be advisable to alter its position; but in all the polarizations these tenths
197 of a degree are to be respectively added to or substracted from the reading.

If, however, the analyst desires to compensate the deviation of the zero point according to the quality of color which suits his eye, and to which he has adjusted the plane of polarization, or in other words, to adjust the zero point himself, there is for that purpose in the mahogany box a small adjusting key, T, which is to be put in the opening or keyhole which lies on the left hand of the telescope, on the immovable setting of the quartz prism; and then, while observing by means of the looking-glass, he moves the vernier to one side or the other until its zero point precisely coincides with the zero point on the scale; that is to say, until both zero points, when seen through the mirror, form a uniform vertical line. Never, however, must the key be put on the four-sided rod which lies on the right side of and below the telescope, and least of all must it be moved by turning, as thereby the entire optical organism would be thrown out of position, and a regulation of the apparatus would have to be made. With regard to the use of quartz plates which accompany the apparatus, an observation tube is to be taken that had best be one hundred (100) meters in length (one-half tube). The cover

glasses are removed, and the quartz plate which is taken for testing the scale is fastened on one end of the same concentrically by the use of three separate drops of wax, by gentle pressure, so that it adheres. Then the capsule is loosely screwed on in such a way that it does not touch the quartz plate, still less press on it, for the rotary power of the plate would be changed by the slightest pressure. The tube is then laid in the apparatus so that the end with the quartz plate lies next to the lamp, and the instrument is then adjusted to equality of color. The reading of the scale must then give the previously determined value of the plate (under the consideration of the fact that the neutral or zero point of the same has not been previously adjusted by the analyst) otherwise the scale would be inexact.

Every one of the four quartz plates is marked with its rotating power, so that it is recommended that care be taken not to confound them in removing from their wrappers.

I have to remark that quartz plates can not be made under 40°, as they would be so thin that their rotatory power would be doubtful and variable.

198 Form of statement to be used as provided in paragraphs 43 and 44. Blanks will be furnished by the department on requisition.

Daily Statement of Classification of Sugar, etc.

U. S. APPRAISER'S OFFICE, —— —, 189-.

Importer.	Name of vessel.	Where from.	Date of entry.	Date of shipment.	Marks and plantations.	No. of packages.	Character of product.	Polariscopic test.	Rate of duty.	Appraised value.	Remarks.

EXHIBIT C, 34769–F, DEC. 15, 1898.

(Copy.)

WASHINGTON, D. C., *March* 15, 1898.

Mr. S. Chevalier, the American Sugar Refining Co., Boston Mass.

SIR: I have to inform you that the glass flasks forwarded to this office on the 3d inst. have been graduated, and as requested they have been returned to you by express. In order to understand the actual capacities of the flasks which are given below, some explanation is perhaps necessary. A standard solution, as defined by the customs service, is a solution of pure sugar (sucrose) and distilled water that contains a *mass* of 26.048 grammes of sugar in 100 true cubic centimetres of solution, at 17.5 centigrade. To avoid the

necessity of reducing the sugar to vacuo, the flasks are graduated to contain 100.06 true cubic centimetres, the excess of 0.06 being the correction for the excess of sugar due to weighing the same in air against brass weights. The actual capacities of the flasks are:

No. 1 100.07 c. c. at 17.5 centigrade.
No. 2 100.06 c. c. at 17.5 centigrade.

Respectfully yours,

(Signed) O. H. TILTMANN,
Acting Superintendent.

199 All communications should be forwarded under cover to the "Superintendent U. S. Coast and Geodetic Survey Washington, D. C."

TREASURY DEPARTMENT,
OFFICE OF THE COAST AND GEODETIC SURVEY,
WASHINGTON, D. C., *June 18th*, 1898.

Mr. John A. Sherer, #122 Front street, New York, N. Y.

SIR: The following table gives the sugar values of the quartz control plate submitted to office per letter of May 27, 1898. The values given are on the basis adopted by the Treasury Department, and of course apply only when flasks standardized by this office are used:

Temp. cent.	Sugar values.	Temp. cent.	Sugar values.	Temp. cent.	Sugar values.
10°	95.38	19°	95.62	28°	95.88
11	.40	20	.65	29	.90
12	.43	21	.68	30	.93
13	.46	22	.71	31	.96
14	.49	23	.74	32	.98
15	.52	24	.76	33	96.01
16	.54	25	.79	34	.04
17	.57	26	.82	35	.07
18	.60	27	.85	36	.10

If Mohr flasks are used the above should be increased by 0.16. The addition of this quantity to the computed value of the plate at 17°.5 cent. gives 95.74, which only differs by 0.01 from the value assigned to the plate by you.

The plate appears to be somewhat defective as may be shown by rotating it in the polariscope. Our observations indicate that the value varies about 0°.10 for different positions and the values given above must be understood to apply only when the screw head in the mounting is up and away from the observer.

The plate will be forwarded by mail under a separate cover.

Yours respectfully, HENRY S. PRITCHETT,
Superintendent.

(Here follows Exhibit 1, marked p. 200.)

Exhibit 1, 34769-F, Dec. 16, 1898.

Table of Corrections to Polarizations for Changes in Temperature from 4° to 40° and for Sugars of from 75 to 100 Per Cent. Purity,
Corrections to be made for the Nearest Whole Degree to the Observed Polarization.
Add Corrections when Temperatures are Above and Subtract when below 17°

Degrees C.	Number nearest observed polarization.	4°	5°	6°	7°	8°	9°	10°	11°	12°	13°	14°	15°	16°	17°	18°	19°	20°	21°	22°	23°	24°	25°	26°	27°	28°	29°	30°	31°	32°	33°	34°	35°	36°	37°	38°	39°	40°
	100	.43	.40	.36	.33	.31	.28	.25	.22	.19	.10	.12	.09	.06	.02	.02	.06	.09	.12	.16	.19	.22	.25	.28	.31	.33	36	.40	.43	.47	.50	.53	.56	.59	.61	.65	.68	.71
	99	.43	.40	.36	.33	.31	.28	.25	.22	.19	.16	.12	.09	.06	.02	.02	.06	.09	.12	.16	.19	.22	.25	.28	.31	.33	.36	.40	.43	.47	.50	.53	.56	.59	.61	.65	.68	.71
	98	.42	.39	.36	.33	.30	.27	.24	.21	.18	.15	.12	.09	.06	.02	.02	.06	.09	.12	.15	.18	.21	.24	.27	.30	.33	.36	.39	.42	.45	.48	.51	.53	.56	.59	.62	.65	.68
	97	.42	.39	.36	.33	.30	.27	.24	.21	.18	.15	.12	.09	.06	.02	.02	.06	.09	.12	.15	.18	.21	.24	.27	.30	.33	.36	.39	.42	.45	.48	.51	.53	.56	.59	.62	.65	.68
	96	.42	.39	.36	.33	.30	.27	.24	.21	.18	.15	.12	.09	.06	.02	.02	.06	.09	.12	.15	.18	.21	.24	.27	.30	.33	.36	.39	.42	.45	.48	.51	.53	.56	.59	.62	.65	.68
	95	.41	.38	.35	.32	.29	.26	.23	.20	.17	.15	.12	.09	.06	.02	.02	.06	.09	.12	.15	.17	.20	.23	.26	.29	.32	.35	.38	.41	.44	.47	.50	.52	.55	.58	.61	.64	.67
	94	.41	.38	.35	.32	.29	.26	.23	.20	.17	.15	.12	.09	.06	.02	.02	.06	.09	.12	.15	.17	.20	.23	.26	.29	.32	.35	.38	.41	.44	.47	.50	.52	.55	.58	.61	.64	.67
	93	.41	.38	.35	.32	.29	.26	.23	.20	.17	.15	.12	.09	.06	.02	.02	.06	.09	.12	.15	.17	.20	.23	.26	.29	.32	.35	.38	.41	.44	.47	.50	.52	.55	.58	.61	.64	.67
	92	.41	.38	.35	.32	.29	.26	.23	.20	.17	.15	.12	.09	.06	.02	.02	.06	.09	.12	.15	.17	.20	.23	.26	.29	.32	.35	.38	.41	.44	.47	.50	.52	.55	.58	.61	.64	.67
	91	.39	.36	.34	.31	.28	.25	.22	.20	.17	.14	.11	.08	.06	.01	.01	.06	.08	.11	.14	.17	.20	.22	.25	.28	.31	.34	.36	.39	.42	.45	.48	.50	.53	.56	.59	.62	.65
	90	.39	.36	.34	.31	.28	.25	.22	.20	.17	.14	.11	.08	.06	.01	.01	.06	.08	.11	.14	.17	.20	.22	.25	.28	.31	.34	.36	.39	.42	.45	.48	.50	.53	.56	.59	.62	.65
	89	.39	.36	.34	.31	.28	.25	.22	.20	.17	.14	.11	.08	.06	.01	.01	.06	.08	.11	.14	.17	.20	.22	.25	.28	.31	.34	.36	.37	.42	.45	.48	.50	.53	.56	.59	.62	.65
	88	.37	.34	.32	.30	.27	.24	.21	.19	.16	.13	.10	.08	.05	.01	.01	.05	.07	.10	.13	.16	.19	.21	.24	.27	.30	.32	.34	.37	.40	.43	.46	.49	.51	.54	.57	.59	.62
	87	.37	.34	.32	.30	.27	.24	.21	.19	.16	.13	.10	.08	.05	.01	.01	.05	.07	.10	.13	.16	.19	.21	.24	.27	.30	.32	.34	.37	.40	.43	.46	.49	.51	.54	.57	.59	.62
	86	.37	.34	.32	.30	.27	.24	.21	.19	.16	.13	.10	.08	.05	.01	.01	.05	.07	.10	.13	.16	.19	.21	.24	.27	.30	.32	.34	.37	.40	.43	.46	.49	.51	.54	.57	.59	.62
	85	.36	.33	.31	.29n	.26	.23	.21	.18	.16	.13	.10	.07	.05	.01	.01	.05	.07	.10	.13	.16	.18	.21	.23	.26	.29	.31	.33	.36	.39	.42	.45	.48	.50	.52	.55	.57	.60
	84	.36	.33	.31	.29	.26	.23	.21	.18	.16	.13	.10	.07	.05	.01	.01	.05	.07	.10	.13	.16	.18	.21	.23	.26	.29	.31	.33	.36	.39	.42	.45	.48	.50	.52	.55	.57	.60
	83	.36	.33	.31	.29	.26	.23	.21	.18	.16	.13	.10	.07	.05	.01	.01	.05	.07	.10	.13	.16	.18	.21	.23	.26	.29	.31	.33	.36	.39	.42	.45	.48	.50	.52	.55	.57	.60
	82	.35	.32	.30	.28	.25	.22	.20	.18	.16	.13	.10	.07	.05	.01	.01	.05	.07	.10	.13	.16	.18	.20	.22	.25	.28	.30	.32	.35	.38	.40	.43	.45	.48	.50	.53	.55	.58
	81	.35	.32	.30	.28	.25	.22	.20	.18	.16	.13	.10	.07	.05	.01	.01	.05	.07	.10	.13	.16	.18	.20	.22	.25	.28	.30	.32	.35	.38	.40	.43	.45	.48	.50	.53	.55	.58
	80	.35	.32	.30	.28	.25	.22	.20	.18	.16	.13	.10	.07	.05	.01	.01	.05	.07	.10	.13	.16	.18	.20	.22	.25	.28	.30	.32	.35	.38	.40	.43	.45	.48	.50	.53	.55	.58
	79	.35	.32	.30	.28	.25	.22	.20	.18	.16	.13	.10	.07	.05	.01	.01	.05	.07	.10	.13	.16	.18	.20	.22	.25	.28	.30	.32	.35	.38	.40	.43	.45	.48	.50	.53	.55	.58
	78	.34	.31	.29	.27	.24	.22	.19m	.17	.14	.12	.10	.07	.05	.01	.01	.05	.07	.10	.12	.14	.17	.19	.22	.24	.27	.29	.31	.34	.36	.38	.40	.43	.46	.48	.51	.53	.56
	77	.34	.31	.29	.27	.24	.22	.19	.17	.14	.12	.10	.07	.05	.01	.01	.05	.07	.10	.12	.14	.17	.19	.22	.24	.27	.29	.31	.34	.36	.38	.40	.43	.46	.48	.51	.53	.56
	76	.34	.31	.29	.27	.24	.22	.19	.17	.14	.12	.10	.07	.05	.01	.01	.05	.07	.10	.12	.14	.17	.19	.22	.24	.27	.29	.31	.34	.36	.38	.40	.43	.46	.48	.51	.53	.56
	75	.32	.30	.28	.25	.23	.21	.18	.16	.14	.12	.09	.07	.05	.01	.01	.05	.07	.09	.12	.14	.16	.18	.21	.23	.25	.28	.30	.32	.35	.37	.39	.41	.44	.46	.48	.51	.53

201 EXHIBIT 2.

34,769 F.

DEC. 16, 1898.

(Series 7, No. 17, Revised.)

United States Internal Revenue.

REGULATIONS

RELATIVE TO THE

BOUNTY ON SUGAR

OF

DOMESTIC PRODUCTION

UNDER THE

PROVISIONS OF THE ACT OF CONGRESS APPROVED OCTOBER 1, 1890.

August 18, 1892.

Washington:
Government Printing Office.
1892.

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Laws in Regard to Sugar.

(Act of October 1, 1890, 26 Stat., 567.)

An act to reduce the revenue and equalize duties on imports, and for other purposes.

SEC. 1.

* * * * * * *

Bounty on sugar.

231. That on and after July 1st, eighteen hundred and ninety-one, and until July first, nineteen hundred and five there shall be paid, from any moneys in the Treasury not otherwise appropriated, under the provisions of section three thousand six hundred and eighty-nine of the Revised Statutes, to the producer of sugar testing not less than ninety degrees by the polariscope, from beets, sorghum or sugar-cane grown within the United States, or from maple sap produced within the United States, a bounty of two cents per pound; and upon such sugar testing, less than ninety degrees by the polariscope, and not less than eighty degrees, a bounty of one and three-fourths cents per pound, under such rules and regulations as the Commissioner of Internal Revenue, with the approval of the Secretary of the Treasury, shall prescribe.

204 Notices, applications for license, and bonds.

232. The producer of said sugar to be entitled to said bounty shall have first filed prior to July first of each year with the Commissioner

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of Internal Revenue a notice of the place of production, with a general description of the machinery and methods to be employed by him, with an estimate of the amount of sugar proposed to be produced in the current or next ensuing year, including the number of maple trees to be tapped, and an application for a license to so produce, to be accompanied by a bond in a penalty, and with sureties to be approved by the Commissioner of Internal Revenue, conditioned that he will faithfully observe all rules and regulations that shall be prescribed for such manufacture and production of sugar.

Licenses.

233. The Commissioner of Internal Revenue, upon receiving the application and bond hereinbefore provided for, shall issue to the applicant a license to produce sugar from sorghum, beets, or sugar-cane grown within the United States, or from maple sap produced within the United States at the place and with the machinery and by the methods described in the application; but said license shall not extend beyond one year from the date thereof.

No bounty to be paid in certain cases. Regulations and Inspection.

234. No bounty shall be paid to any person engaged in refining sugars which have been imported into the United States, or produced in the United States upon which the bounty herein provided for has already been paid or applied for, nor to any person unless he shall have first been licensed as herein provided, and only upon sugar produced by such person from sorghum, beets, or sugar-cane grown within the United States, or from maple sap produced within the United States. The Commissioner of Internal Revenue, with the approval of the Secretary of the Treasury, shall from time to time make all needful rules and regulations for the manufacture of sugar from sorghum, beets, or sugar-cane grown within the United States, or from maple sap produced within the United States, and shall, under the direction of the Secretary of the Treasury, exercise supervision and inspection of the manufacture thereof.

Payment of bounties. No bounty upon less than five hundred pounds.

235. And for the payment of these bounties the Secretary of the Treasury is authorized to draw warrants on the Treasurer of the United States for such sums as shall be necessary, which sums shall be certified to him by the Commissioner of Internal Revenue, by whom the bounties shall be disbursed, and no bounty shall be allowed or paid to any person licensed as aforesaid in any one year upon any quantity of sugar less than five hundred pounds.

Penalties.

236. That any person who shall knowingly refine or aid in the refining of sugar imported into the United States or upon which the

bounty herein provided for has already been paid or applied for, at the place described in the license issued by the Commissioner of Internal Revenue, and any person not entitled to the bounty herein provided for, who shall apply for or receive the same, shall be guilty of a misdemeanor, and upon conviction thereof, shall pay a fine not exceeding five thousand dollars, or be imprisoned for a period not exceeding five years, or both, in the discretion of the court.

Import duties. Beet-sugar machinery free until July 1, 1892.

237. All sugars above number sixteen Dutch standard in color shall pay a duty of five-tenths of one cent per pound: *Provided*, That all such sugars above number sixteen Dutch standard in color shall pay one-tenth of one cent per pound in addition to the rate herein provided for, when exported from, or the product of any country when and so long as such country pays or shall hereafter pay, directly or indirectly, a bounty on the exportation of any sugar that may be included in this grade which is greater than is paid on raw sugars of a lower saccharine strength; and the Secretary of the Treasury shall prescribe suitable rules and regulations to carry this provision into effect.

And provided further, That all machinery purchased abroad and erected in a beet-sugar factory and used in the production of raw sugar in the United States from beets produced therein shall be admitted duty free until the first day of July, eighteen hundred and ninety-two: *Provided*, That any duty collected on any of the above described machinery purchased abroad and imported into the United States for the uses above indicated since January first, eighteen hundred and ninety, shall be refunded.

238. Sugar candy and all confectionery, including chocolate confectionery, made wholly or in part of sugar, valued at twelve cents or less per pound, and on sugars after being refined, when tinctured, colored, or in any way adulterated, five cents per pound.

239. All other confectionery, including chocolate confectionery, not specially provided for in this act, fifty per centum *ad valorem*.

240. Glucose, or grape sugar, three-fourths of one cent per pound.

Provisions take effect April 1, 1891.

241. That the provisions of this act providing terms for the admission of imported sugars and molasses and for the payment
206 of a bounty on sugars of domestic production shall take effect on the first day of April, eighteen hundred and ninety-one.

Free list.

SEC. 2.

* * * * * * *

726. Sugars, all not above number sixteen Dutch standard in color, all tank bottoms, all sugar drainings, and sugar sweepings, sirups of cane juice, melada, concentrated melada, and concrete and concentrated molasses, and molasses.

Conditional duty on sugar.

SEC. 3. That with a view to secure reciprocal trade with countries producing the following articles, and for this purpose, on and after the first day of January, eighteen hundred and ninety two, whenever and so often as the President shall be satisfied that the Government of any country producing and exporting sugars, molasses, coffee, tea, and hides, raw and uncured, or any of such articles, imposes duties or other exactions upon the agricultural or other products of the United States, which in view of the free introduction of such sugar, molasses, coffee, tea, and hides into the United States he may deem to be reciprocally unequal and unreasonable, he shall have the power and it shall be his duty to suspend, by proclamation to that effect, the provisions of this act relating to the free introduction of such sugar, molasses, coffee, tea, and hides, the production of such country, for such time as he shall deem just, and in such case and during such suspension, duties shall be levied, collected, and paid upon sugar, molasses, coffee, tea, and hides, the product of or exported from such designated country as follows, namely:

All sugars not above number thirteen Dutch standard in color shall pay duty on their polariscopic tests as follows, namely:

All sugars not above number thirteen Dutch standard in color, all tank bottoms, sirups of cane juice or of beet juice, melada, concentrated melada, concrete and concentrated molasses, testing by the polariscope not above seventy five degrees, seven-tenths of one cent per pound; and for every additional degree or fraction of a degree shown by the polariscopic test, two hundre-ths of one cent per pound additional.

All sugars above number thirteen Dutch standard in color shall be classified by the Dutch standard of color, and pay duty as follows, namely: All sugar above number thirteen and not above number sixteen Dutch standard of color one and three-eight-s cents per pound.

All sugar above number sixteen and not above number twenty Dutch standard of color, one and five-eighths cent per pound.

All sugars above number twenty Dutch standard of color, two cents per pound.

207 Molasses testing above fifty-six degrees, four cents per gallon.

Sugar drainings and sugar sweepings shall be subject to duty either as molasses or sugar, as the case may be, according to polariscopic test.

* * * * * * *

NOTE.—Under this provision the President issued proclamations March 15, 1892, suspending from that date the provisions of the act relating to the free introduction of sugar, and declaring the duties set forth in section 3, in force as to sugar the product of or exported from Columbia, Haiti, and Venezuela.

Alcohol free of tax for making sugar from sorghum.

(Extract from act approved March 3, 1891, making appropriations for the Department of Agriculture for the fiscal year ending June 30, 1892, 26 Stat., 1050.)

That any manufacturer of sugar from sorghum may remove from distillery warehouses to factories used solely for the manufacture of such sugar from sorghum, distilled spirits in bond free of tax, to be used solely in such manufacture of sugar from sorghum; that all distilled spirits removed as herein authorized shall be of an alcoholic strength of not less than one hundred and sixty per centum proof, and may be removed, stored, and used in the manufacture of sugar from sorghum, and when so used may be recovered by redistillation in the sugar factory of such sugar manufacturer under such bonds, rules and regulations for the protection of the revenue and the accomplishment of the purposes herein expressed as the Commissioner of Internal Revenue, with the approval of the Secretary of the Treasury, may prescribe.

Any person who removes or uses distilled spirits in violation of this provision, or the regulations issued pursuant thereof, shall, on conviction thereof, be fined not less than one thousand dollars nor more than five thousand dollars for each offense, and the spirits and the premises on which such spirits are used shall be forfeited to the United States.

Inspectors.

(Extract from act of March 3, 1891, making appropriations for the legislative, executive, and judicial expenses of the Government for the fiscal year ending June 30, 1892, 26 Stat., 925.)

The Commissioner of Internal Revenue is authorized to employ not to exceed twelve inspectors at a salary not exceeding five dollars per day and necessary expenses, whose duty it shall be to inspect sugar upon which a bounty is required to be paid under the act of Congress entitled, "An act to reduce the revenue and equalize duties on imports, and for other purposes," approved October
208 first, eighteen hundred and ninety; to aid in ascertaining the amount of bounty due thereon, and to perform such other duties as may be required by the Commissioner of Internal Revenue.

(Series 7, No. 17—Revised)

BOUNTY ON SUGAR.

REGULATIONS

RELATIVE TO

BOUNTY ON SUGAR UNDER THE PROVISIONS OF THE ACT APPROVED OCTOBER 1, 1890.

TREASURY DEPARTMENT,
OFFICE OF INTERNAL REVENUE,
WASHINGTON, *August* 18, 1892.

The act of Congress, approved October 1, 1890, entitled "An act to reduce the revenue and equalize duties on imports and for other purposes" (Schedule E), provides:

(231.) That on and after July first, eighteen hundred and ninety-one, and until July first, nineteen hundred and five, there shall be paid, from any moneys in the Treasury not otherwise appropriated, under the provisions of section three thousand six hundred and eighty-nine of the Revised Statutes, to the producer of sugar testing not less than ninety degrees by the polariscope, from beets, sorghum, or sugar cane grown within the United States, or from maple sap produced within the United States, a bounty of two cents per pound; and upon such sugar testing less than ninety degrees by the polariscope, and not less than eighty degrees, a bounty of one and three-fourths cents per pound, under such rules and regulations as the Commissioner of Internal Revenue, with the approval of the Secretary of the Treasury, shall prescribe.

It further provides that "the Commissioner of Internal Revenue, with the approval of the Secretary of the Treasury, shall from time to time make all needful rules and regulations for the manufacture of sugar from sorghum, beets, or sugar cane grown within the United States, or from maple sap produced within the United States, and shall, under the direction of the Secretary of the Treasury, exercise supervision and inspection of the manufacture thereof."

Under this authority, the following regulations are prescribed by the Commissioner of Internal Revenue, with the approval of the Secretary of the Treasury.

When the act took effect.

The provisions of the act of October 1, 1890, providing terms for the payment of the bounty, took effect on the first day of
209 April, 1891; that is, April first was the date when applications for licenses might be made and the notices and bonds filed, and the law became operative so far as authorizing the issuing of licenses by the Commissioner of Internal Revenue, but no bounty was payable on sugar produced prior to July 1, 1891.

The words "current or next ensuing year," in paragraph 232, are understood to mean the fiscal year, or the bounty year, commencing July first.

The bounty period.

The period during which bounty is payable is specified in paragraph 231 as "on and after July first, eighteen hundred and ninety-one, and until July first, nineteen hundred and five;" that is, during a period of fourteen years.

Notice and application for license.

All producers of sugar who intend to apply for the bounty on the sugar produced, in order to entitle themselves thereto, must, prior to July first of each year, file a notice of the place of production with a description of the machinery and methods to be employed, and an estimate of the amount of sugar proposed to be produced in the next ensuing year, including the number of maple trees to be tapped, and make an application for a license.

This notice must be in duplicate, and be filed with the collector of internal revenue of the proper district, who will retain one copy and forward the other to the Commissioner of Internal Revenue.

The application for license will be on the same form as the notice.

Producers of sugar from beets, sorghum, or sugar cane will use form No. 287 for giving the notice and making the application required.

Producers of sugar from maple sap, in giving their notice and making their application for license, will use form No. 288, revised.

The blanks in these forms should be properly filled, and in case of any change in the method of manufacture, location, or otherwise, occurring subsequently to the date of the notice, a supplemental notice shall be immediately given to the collector of the district or the deputy collector of the division.

The notice and application for license may be signed by the agent, manager or superintendent, or other person duly authorized by the principal.

In the case of a firm, the notice and application for license may be signed in the firm name by any individual member thereof.

In the case of a corporation, the full corporate name, and that the corporation has been duly organized under the laws of the State, must be shown, and the notice and application for license must be signed with the corporate name and with the name and title of the officer duly authorized to sign for the company, such signature to be authenticated by the corporate seal.

210 In filling the blanks in form 287, the producer will state under the proper heading the number of acres proposed to be planted in cane by himself and the probable yield in tons of cane per acre; and under the next heading, he will state the estimated quantity of cane proposed to be purchased from outside parties. The estimate of the yield of cane per acre will be based on the average yield of previous seasons. Where sugar cane is raised

it is to be considered as topped and stripped ready for the mill, and the estimate will be made on that basis; if sorghum cane is raised, it is to be considered as topped but not stripped. The subheads, "Plant" and "Stubble" do not apply to sorghum.

In case sirup is purchased and worked into sugar full information must be furnished as to the apparatus used in producing the sirup, its capacity, the estimated quantity of cane to be used for the season, the location of the sirup factory, its distance from the factory purchasing the sirup, and the manner in which the sirup is to be transported. Where the party giving the notice proposes to work sirup into sugar on contract for other parties who produce the sirup and retain ownership, full information must be furnished as to the estimated quantity of sirup to be so worked, the names of the parties for whom it is to be worked, and the manner in which the sirup is to be transported.

The terms of the contract must be stated, but the amount to be paid by the producer need not be stated. Enough of the contract must be given to show its general character, to enable the Internal Revenue Bureau to determine who is in law the producer and entitled to the bounty.

The evaporative capacity of vacuum evaporators may be stated either in number of gallons of water the apparatus is capable of evaporating per twenty-four hours, or in number of gallons of juice it is capable of evaporating from 8 degrees to 30 degrees Baumé.

In cases where the sugar producer has his sirup worked into the sugar at another factory it is not necessary that the number of evaporators, vacuum strike pans, centrifugals, etc., the apparatus belonging to the factory or refinery where the sirup is made into sugar, shall be stated. It is only his own apparatus to be used by him in making the sirup which must be stated in the notice.

Bonds.

Sugar producers who intend to apply for the bounty on sugar produced must also execute a bond with two or more sureties according to the prescribed form, which must accompany the notice and application for license and be filed prior to July first of each year. The instructions printed on the bond must be particularly observed and complied with.

The form of bond for producers of sugar from beets, sorghum, or sugar cane is No. 278.

211 Producers of sugar from maple sap will use form 288, revised, which includes, also, the notice and application for license.

Collectors will, in addition to a careful examination of the sufficiency of all sureties offered, require the sureties to bonds on form No. 278 to justify in amounts which, in the aggregate, should not be less than the penal sum of the bond.

When the same sureties appear on several bonds inquiries should be made as to their responsibility for the entire amount for which they may become liable.

These bonds, after the sufficiency of the sureties has been certified by the collector of the district, must be transmitted to the Commissioner of Internal Revenue for approval.

Individual sureties must reside in the same collection district with the principal, except in cases where the collector is otherwise specially instructed.

The collector is to be the judge of the sufficiency of the sureties. If a guarantee company, authorized by law to become surety on bonds and undertakings, should be tendered as a surety on a sugar producer's bond, the collector cannot accept the same if the company is within the jurisdiction of the United States court of the district in which the collector's office is located, or has a resident agent there, duly authorized to accept service, or upon whom service may be made in case of suit, and has money or property subject to execution or process sufficient in amount to meet all probable demands upon it.

A copy of the charter and by-laws of such company, if accepted as a surety, with a statement of its financial condition and a certificate of the appointment of the party authorized to accept service in any suit brought against the company, must be filed in the office of the Commissioner of Internal Revenue, and also in the office of the collector.

In the case of a firm executing a bond the name of each person constituting the firm, as well as the style of the firm, must be stated in the recital, as, for instance, "John Doe and Richard Roe, doing business as Doe and Co.," and the bond must be signed and execution acknowledged by each member of the firm. The firm name shall be signed first, followed by the signature of each member. One member of a firm can not sign for the other members unless he has a full power of attorney, executed under seal and duly acknowledged, giving him authority, and in such cases the original power of attorney must be attached to the bond.

In the case of a corporation, the full corporate name, and that the corporation has been duly organized under the laws of the State, must be shown in the recital, and the bond must be signed with the corporate name, and with the name and title of the officer duly authorized to sign for the company by the by-laws, or by resolution at some meeting of the company or the directors, a copy of which resolution or by-laws shall accompany the bond. The signature
212 of the corporation as principal on the bond shall be authenticated by the corporate seal of the company.

In case an administrator of an estate, or an executor, proposes to engage in business as sugar producer and give a bond, such person must show by what authority he proposes to carry on business as sugar producer, and cite the law of the State, or furnish an order of court permitting him to do so.

The office of a tutor under the law of Louisiana is equivalent to that of guardian under the common-law. A tutor giving bond must furnish a certified copy of the order of court appointing him tutor.

In case of agents who propose to carry on business and give bond as sugar producers, proper authority to act as agents must be shown.

They must furnish a power of attorney from the principals, executed under seal, giving authority to the agent to execute a bond. The bond shall be signed in the name of the principal by the duly authorized agent, who will sign his name as such agent.

If women are engaged in business as producers and give a bond, it must be shown whether they are married or single, and, if married, whether the law of the State authorizes married women to give a bond.

The penal sum of the bond will be fixed by the collector of internal revenue, and will be equal to at least one-half the bounty on the amount of sugar proposed to be produced during the year, reckoned at two cents per pound, but will not in any case be less than $100.

If in any case the collector is of the opinion that the location of the factory is such as would enable the producer to defraud the Government he will report the facts to the Commissioner of Internal Revenue in forwarding the bond, and in such cases approval will be withheld until all required conditions are satisfactory.

A new bond will be required in case of the death or insolvency of the sureties, or in any other contingency, at the discretion of the Commissioner of Internal Revenue.

Collectors will report the facts whenever in their opinion a contingency arises which renders it proper that a new bond should be required to protect the interests of the Government.

The names and residences of sureties upon the bonds of sugar producers and other data relative to bonds will be entered in the collector's record of bonds received. (Book No. 38.)

Collectors will inform sugar producers, as far as practicable, of the requirement that the notice, application for license, and bond must be filed prior to July first in order to entitle the applicant to obtain a license for the next ensuing year, so that no one intending to manufacture sugar and apply for the bounty may fail to file the necessary papers within the time prescribed by law. Applications for license with bond must be mailed seasonably, so as to reach the collector's office before the first day of July.

213 Licenses.

Collectors will forward the notices, applications for licenses, and bonds of sugar producers to the Commissioner of Internal Revenue as soon as they have been examined and are satisfactory.

If the same, upon examination, are found in due form, and are approved by the Commissioner, licenses will be issued without charge through the collector of internal revenue, and the same must be kept conspicuously displayed in the place or estab-ment where the sugar is produced.

The licenses will be numbered consecutively in each district, commencing with No. 1, and each factory will be designated by the same number. Licenses expire on the 30th of June of each year.

There is no provision in the law for transferring a license.

Bounty.

Upon sugar testing 80 to 90 degrees by the polariscope the bounty will be 1¾ cents per pound, and upon sugar testing 90 degrees and above, 2 cents per pound.

There is no bounty on sirup which is not made into sugar, nor upon sugar testing less than 80 degrees by the polariscope—that is, containing less than 80 per cent. of sucrose or pure sugar.

The law provides that "no bounty shall be allowed or paid to any person licensed as aforesaid in any one year upon any quantity of sugar less than five hundred pounds."

A licensed sugar producer who makes more than 500 pounds of sugar during the year is not entitled to the bounty unless he makes 500 pounds testing 80 degrees or over.

The law provides that no bounty shall be paid to any person engaged in refining sugars which have been imported into the United States or produced in the United States upon which the bounty has already been paid or applied for, nor to any person unless he shall have first been licensed, and only upon sugar produced by such persons from sorghum, beets or sugar cane grown within the United States, or from maple sap produced within the United States.

If a planter or farmer sells the cane which he has raised, or the sirup which he has produced, at any period before the manufacture of sugar is completed, he will have no right to the bounty on the completed product.

Polariscopic test.

It will be necessary under the law to classify the sugar for payment of the bounty according to the polariscopic test.

The polariscope is an instrument which determines the per cent. of pure sugar in any given sample without regard to its color or condition. The sample of sugar to be tested is carefully
214 weighed and dissolved in an exact volume of water, and a ray of polarized light is passed through the solution. In passing through the solution *the ray is deviated in proportion to the amount of pure sugar which the solution contains. This instrument measures the deviation of the ray upon a scale of one hundred degrees.*

When sugar tests eighty degrees, it is eight-tenths pure sugar. There will be no bounty upon any sugar which does not contain 80 per cent. of sucrose or pure sugar.

Supervision and inspection of factories for the production of sugar from beets, sorghum, or sugar cane.

All deputy collectors in charge of divisions in which factories for the production of sugar from beets, sorghum, or sugar cane are located will be expected to become thoroughly familiar with the construction and operation of such establishments and with the law and regulations upon the subject.

After a license has been issued the collector will furnish the deputy in charge of the division within which the factory is located,

or other deputy, agent or officer assigned to the duty of inspecting factories, with a copy of the notice and application for license. Before the factory commences to operate under the license such deputy, agent or officer will proceed to the location of the factory and thoroughly inspect the premises, buildings and machinery used in the business. He will see that the items of information furnished in the notice were correctly stated adding to the copy of the notice such changes, if any, as may be found necessary.

He will give the sugar producer instructions as to the manner in which his books must be kept and his reports rendered.

Operations must begin under the license with no molasses, sirup, materials for making sugar, or sugar on hand from the previous season, except such molasses, third product or wagon sugars as the sugar producer has been allowed by the department to retain on the premises for subsequent treatment as material in process.

Final molasses, which will yield no more sugar, may remain on storage in the factory from one licensed period to another.

Collectors will see that each establishment for the production of the sugar from sorghum, beets, or sugar cane is kept under strict surveillance while in operation.

The factories shall be frequently visited by the division deputy collector or other officers assigned to that duty and the stock and premises carefully examined. The sugar put up shall be examined to see that the packages are correctly marked and branded. The principal object of the inspection is to ascertain that everything is regular; that no sugar comes to the factory from outside, and that no sugar remains in the factory after it has been weighed and inspected. The premises shall be carefully examined to see if there is any evidence that sirup or sugar has been received irregularly.

215 The books of railroad and other transportation companies shall be examined to see whether any sugar or sirup arrives at that point in an unusual manner, and, if so, it must be traced and the facts in regard to it ascertained.

The deputy or officer will note the processes employed in the manufacture and closely observe the operations to see whether the same correspond with the statements made by the sugar producer in his notice and application for license, and to satisfy himself as to the sugar producing capacity of the establishment. He will particularly inspect the book required to be kept by the sugar producers, and make comparisons with his returns, and if any apparent discrepancy or omission is found, he will require any other books or records kept to be submitted for his examination and comparison with the entries in the Government book. Any material omission or delinquency in keeping the book he will immediately report to the collector. Omissions or erroneous methods of keeping the book arising from ignorance he will require to be corrected.

Investigations shall be made of shipments of sales to customers in the vicinity, and of removals for consumption, and any discrepancy, irregularity, or suspicious circumstances must be immediately reported to the collector.

When cane or sirup is purchased, particular attention shall be

given to the accounts. The records of the planters from whom purchases are made shall be compared with the sugar producer's books to see that no purchases are made of sirup except from persons growing the cane and producing the sirup.

The collector will promptly report to the Commissioner any violation of law or regulations, or any matter requiring special investigation.

When the sugar factories have ceased operations for the season, they shall be inspected by the proper inspector or deputy collector, and an examination made of the books to see that the accounts have been properly kept, and that the proper inventory has been taken and record made of the wagon sugars left over to be worked into sugar at a later period.

Requirements to be Observed by Producers of Sugar from Beets, Sorghum, or Sugar Cane.

Notice of intention to commence.

Before commencing business under his license the producer of sugar from beets, sorghum, or sugar cane will notify the collector of the date and time when he expects to commence operations.

This notice should be made whenever the date is fixed and may be made in form as follows:*

216

——, ——,
——, ——, 189–.

To —— ——, collector of internal revenue, district of ——.

SIR: I intend to commence operations at my sugar factory, license No. —, on the — day of ——, 189–, at — o'clock — m., in accordance with my notice and application for license heretofore made.

I have no sugar, molasses, or materials for making sugar on hand at said factory, except as follows:

—— ——,
Sugar Producer.

If the producer has been licensed the previous year and has any sugar, molasses, or material on hand left over from the previous season, he will report the quantity on hand in his notice, and state when the same will be worked up or removed.

Packages.

Licensed producers of sugar from beets, sorghum, or sugar cane must pack all sugars manufactured by them in either bags, barrels, half barrels, or hogsheads, or in such other form as may be approved by the Commissioner of Internal Revenue.

* This office does not furnish any printed forms for this notice.

Marking packages.

The packages of all sugar put up must be numbered serially commencing each season or licensed period with number 1.

The packages must also be marked with the producer's name, and the name of the plantation or place of production, the kind or grade of sugar, and the gross, the tare, and the net weights thereof. These numbers and marks must be put on the package in a legible and durable manner, and in case of barrels or hogsheads on the head thereof. The empty packages shall be weighed by the sugar producer before they are packed and the weight of the same marked thereon.

In the case of sugar put up in bags of a uniform size and weight, the gross weight and tare need not be marked upon the bags of sugar so put up.

Weights not required to be placed on packages by the sugar producer in certain cases.

If sugar producers have no facilities for weighing sugar, and desire to ship it from the place of production to a central place before it is weighed, they may be permitted to do so. In such cases the packages shall be marked by the sugar producer as above required, with the exception of the weights, which shall be put on by the Government weigher when the packages are weighed.

217 Hydrometers.

Every sugar producer must provide himself with either a Baumé or Brix hydrometer, for determining the density of juice, in order to make correct entries in the book as required.

The hydrometer must also be used to ascertain the density of sirup in case any is purchased or sold, entry of which is also required.

Lots and bills of lading.

Sugars upon which bounty is claimed shall be packed and shipped in lots of the same grade and kind.

When sugars are shipped the number of the lot must be put on the package as an identification and as a means of describing the same in bills of lading and notice to collector of the shipment, and these consecutive lot numbers shall be designating marks as well as the serial numbers for all purposes of weighing, sampling, testing, etc.

When sugars are shipped the bills of lading shall describe all the marks and numbers appearing upon the packages, and duplicate bills of lading shall be taken, one copy to be furnished to the collector of internal revenue.

When the sugar is shipped to a central place to be weighed, the bill of lading will be furnished to the collector with the consignee's notice of arrival of sugar (form No. 299). In other cases the extra bill of lading furnished by the railroad or steamship company to the producer can be given to the deputy collector who weighs the sugar at the factory, to be sent by him to the collector.

Weighing sugar. Scales for weighing. Desk room for weighers and sampling instruments.

All the manual labor connected with and incident to the weighing and inspection of sugar must be furnished by the sugar producer.

When sugars are officially weighed and inspected at the factory, the producer must furnish the scales required for such purpose and the same must be kept to conform with the United States standard, and when the sugar is weighed at the factory or elsewhere the packages must be arranged in such a manner as will best facilitate the operations of weighing and inspecting.

Producers must also furnish weighers stationed at their factories with the necessary desk room for making out their reports, and with locked closets, etc., so as to enable them to keep their samples and papers under lock and key, and they must also furnish the necessary sampling instruments, tin boxes and chests for containing samples and pay the expense of transporting samples.

218 Removal of sugar after being weighed.

The packages must be removed from the factory immediately, or as soon as practicable after being weighed and sampled, to a warehouse separate from the factory pending shipment. A warehouse under the same roof is adjudged separate if partitioned off by itself and used for no other purpose but storing sugar, and is subject to the control of an internal revenue officer. Sugar intended for home use or local consumption must be removed from the factory or the room where the weighing of other sugar is to follow, immediately after being weighed and sampled. A failure to comply with this requirement will be sufficient cause for withholding draft for payment of bounty.

Sugar producers may keep their sugar at the place of production, if they desire, until they are ready to have it weighed and inspected; but if it has been shipped from the place of production to a central place, it shall be weighed and inspected upon its arrival, or as soon thereafter as practicable.

Access to buildings.

Sugar producers will be required to furnish revenue officers, or other persons who may be authorized to make inspection of the sugar factories, access to any building or place used in connection with the business at all times, and furnish necessary assistance and facilities for making examination of the premises and taking account of the apparatus, material, or products.

Books.

Every licensed producer of sugar from sorghum or sugar cane is required to provide, at his own expense, a book, in which shall be entered daily the quantity of materials used for the production of sugar, the quantity of juice obtained and its average density, the

number of hours the mill was in operation, the quantity of sugar, in pounds, of each grade produced and packed, with the number and kinds of packages and the serial numbers of the same, the quantity of sugar shipped, sold, or removed for sale, consumption, or storage, and the name and address of the person to whom shipped, sold, or disposed of.

When cane is purchased, the book must show the name of the person or persons from whom purchased, and the amount from each. When sirup is purchased, the book must show the quantity purchased, and its average density, the name and address of persons from whom purchased, and the quantity in tons and acres of cane from which the sirup was produced, so that the sirup purchased can be traced back directly to the cane. When the number of acres of cane cannot be accurately ascertained, an estimate shall be made. If
the column for the names and addresses of persons from
219 whom cane or sirup is purchased is not sufficient to contain all the entries necessary, the data shall be kept on blank leaves in another portion of the book, or in another book, and reference made in the column to the book and the page.

For the purposes of this record a day shall be considered as beginning at 6 o'clock a. m. of the day specified—for example, the entries for any given date must include all operations between the hours of 6 a. m. of the day for which entry is made and 6 a. m. of the following day.

In determining the number of hours the mill is operated each day, the computation is to be based upon the time during which cane is consumed by the mill (or by the cutters and comminutors, if diffusion process is used), without regard to the operation of the rest of the factory. No deduction should be made for the stoppages of the mill of less than fifteen minutes' duration.

For ascertaining the density of juice obtained the sugar producer can use either Baumé or Brix hydrometer, specifying at the head of the column the hydrometer used.

In the account of cane used, if no scales are kept at the factory upon which the cane can be weighed, the quantity may be estimated. In such cases the number of car, wagon, or cart loads shall be stated, and the cart or wagon described as two wheeled or four wheeled, and the number of animals used to draw each load stated. A ton is to be reckoned at 2,000 pounds.

Cut seconds, or any sugars grained in the strike pan, shall be entered as first sugars.

It is desirable that in addition to the data required to be kept on the prescribed form, memoranda be made of the general operations of the factory, giving the number of strikes of different kinds of sugar made, the number of stoppages and causes of each. This can be entered in the column headed "Remarks or memoranda."

In case the manufacture of sugar is carried on by the open-kettle process, the entry of sugar produced shall be made only when the process is completed; that is to say, whenever the hogsheads or other packages are filled and closed for numbering and marking. The number and kind of the packages shall then be entered and their

serial numbers recorded, and also the net pounds, where facilities exist for weighing. Although it may be that the sugars entered on a given day as produced and packed have been for a considerable time in process of manufacture, the process has not been finished and the package can not be numbered and marked, nor weighed, until the process is completed; and when this time arrives and the packages are closed, the numbering, marking, and weighing, if practicable, must be done at once and the entries thereof made on the day when the same takes place.

It will be the duty of sugar producers who purchase from planters and farmers sirup made from cane to require the persons who make the sirup to keep books showing the quantity of cane raised, the quantity of juice produced, the quantity of sirup made, the
220 name of the parties to whom it is sold, with the date of shipment, route shipped, and full particulars of shipment, which books must be open to inspection by Government officers the same as the sugar producer's books.

If a planter or farmer sends the sirup produced by him from cane to another factory to be made into sugar, still retaining the ownership of the sirup and the product, his books must show full details of amount of sirup shipped, date of shipment, route, etc., as well as the quantity of cane ground and sugar produced, and the manufacturer of the sugar must keep such sirup and product distinct from any other and make such additional entries in his books as will enable the Government officers to trace each lot of sugar made to the sirup and to the cane from which it was produced.

In this case the sugar producer's books shall be made to contain additional columns showing the quantity of sirup produced and its average density, the quantity shipped to be worked into sugar, to whom shipped, date of shipment, and route shipped.

The sugar producer must require the factory in which the sirup is worked to furnish him the data necessary to complete his record, so that it will show the quantity of sugar produced at the central factory and the different grades, and the disposition made of the same.

The factory working such sirup into sugar must keep a separate record of its operations on the prescribed form for each person for whom sirup is worked, with such additional columns as may be necessary to show the gallons of sirup received, and its average density, and from whom received, date of receipt, and route.

Every producer of sugar from beets is required to provide, at his own expense, a similar book, in which daily entries shall be made showing the quantity of materials use-, quantity of sugar produced, etc., according to the form prescribed.

Form No. 293 is prescribed for the form of book to be kept by producers of sugar from beets. Form No. 295 is prescribed for the form of book to be kept by producers of sugar from sorghum or sugar cane.

It should be understood that this office does not furnish the books and that none can be had through internal-revenue officers. Those

who are required to keep the books in the form prescribed have a right to procure them from any source they see fit.

There is no copyright upon books made according to this form. Any bookseller or stationer has general authority to make and keep the books for sale, and can obtain a copy of the form prescribed upon application.

Officers of internal revenue are requested to afford every facility to secure a distribution of these forms among sugar producers, so that they may supply themselves with books printed according to the form prescribed before commencing to manufacture sugar under their license.

These books must be kept at the sugar factory and be always
221 open to the inspection of any revenue officer, and when filled up shall be preserved by the sugar producer for a period of not less than two years thereafter, and whenever required shall be produced for the inspection of any revenue officer.

If the sugar producer, for his own convenience, keeps additional books containing a more extended record of the operations of the factory, they shall also be open to inspection in like manner.

Rule for ascertaining the average density of juice produced at sugar factories during a month or any other given time.

Multiply the quantity in gallons produced each day by the average density for the day, which will give the quantity produced each day in gallons of density of a single degree. Add these quantities, which will give the aggregate production of the month or other period in gallons of density of a single degree. Divide this quantity by the entire number of gallons of juice actually produced during the month or given period, and the quotient will be the average density of the whole quantity of juice produced.

Illustration of the rule.—A factory produces juice of density as follows:

	Gallons.	Density.
October 1	29,625	6.6
October 2	30,750	8.4
October 12	11,721	4.
		19

These three days have an aggregate density of 19 degrees, or an average of 6.33 + daily. If the production of juice had been alike each day, the daily average would be correct for the full amount of juice, but as there were different quantities of juice produced its average density will be shown by the rule as follows:

29,625 x 6.6=195,525 gallons in density of a single degree.
30,750 x 8.4=258,300
11,721 x 4. = 46,884

Total..72,096	500,709

Dividing 500,709 (gallons of density of a single degree) by 72,096 (total number of gallons produced) we find the average density of the juice produced to be 6.945+.

Monthly returns.

Every producer of sugar from sorghum or sugar cane is required to make a monthly return, in duplicate, on form No. 296, stating the quantity of materials used for the production of sugar, the quantity and kind of sugar produced, the quantity shipped
222 or removed, the serial numbers of the packages, and the name and address of the consignee or person to whom the goods were shipped, sold, or disposed of.

Producers of sugar from beets will make a similar return on form No. 294.

The return is to be taken from the sugar producer's books, and is to be rendered to the collector on the first day of each month, or within five days thereafter, verified under oath or affirmation by the sugar producer or principal manager of the factory.

The sugar producer who buys cane sirup and makes it into sugar must obtain a return from the person from whom the sirup was purchased, taken from his books, showing the quantity of cane cut and the quantity of sirup made, to whom delivered, and date when delivered, which shall accompany his own return to the collector.

The collector will examine the return upon the receipt thereof, and, if it fulfills the requirements and needs no correction, he will forward one copy to the Commissioner of Internal Revenue, retaining the other.

The monthly return must be made while any sugar remains in the factory, although the other items to be returned may be those which relate to the shipment or removal of the sugar.

If, at the close of the month for which the return is made, the factory is in active operation, an estimate must be made of the amount of sugar which is in process of manufacture, and the amount entered in the return in the proper place. This estimate shall be made as accurately as possible, and based upon the average yield for the season or preceding season. It should include all sugars not packed.

Sugar producers who have closed their factory for the season, and have no sugar on hand which has not been weighed and sampled, except thirds or wagon sugars, which are to be kept over until the beginning of next season to be worked into sugar, need not be required to make monthly returns during the interim while the factories are not in operation.

The final return of the season should have a statement written across the face substantially as follows:

All work ceased in factory on — (giving date). Have on hand in — (designate where, as in hot rooms, for instance) — cars (designate kind and number of receptacles, cars, wagons, or tanks) of second, third, or string sugars, estimated at — pounds of sugar, in process of manufacture. Process to be completed next season.

Annual returns.

An annual return will be required from each producer of sugar from beets, sorghum, or sugar cane at the close of the fiscal year, giving a complete summary of the year's operations in addition to the regular monthly returns.

223 This return will be made to the collector of internal revenue immediately after the first of July of each year, in duplicate, on form No. 297.

The annual return of sugar producers (form 297) may be made at any time before the first of July, if operations for the fiscal year have been completed.

Relative to low grade products or wagon sugars kept over till the following season.

If the sugar producer, at the close of operations for the season, desires to keep the low grade products or material in process of manufacture over until the beginning of the following season to be worked into sugar under a new license, he will be allowed to do so upon complying with the following requirements: The amount of material shall be accurately ascertained and the quantity entered in the sugar producer's book and reported on form No. 294 or form 296, as the case may be, as in process of manufacture. The material shall be pdaced in tanks or other receptacles, and an inventory of the same furnished to the inspecting officer, who will verify the same and file it with the collector of internal revenue.

This material may be worked up either before the next grinding season commences, or in connection with the new crop, as the producer prefers. In either case the producer must notify the collector in advance of his intention, in order that the factory may be officially inspected.

Materials which have been offered for sampling and weighing shall be considered out of process and completed, and it shall be unlawful to further manipulate them in any manner on the premises of the sugar producer.

The factories will be again inspected before they commence operations the following season, and the officer assigned to the work will see that the material then on hand corresponds with the amount left over at the close of the previous season.

Beet-sugar factories holding molasses over from one season to another will be required to so arrange their molasses tanks that they will be in a room or building where they can be securely locked and sealed.

Relative to manufacture of sirup into sugar by central factories for licensed sugar producers.

Where a sugar producer has obtained a license to produce sugar under the provisions of the act of October 1, 1890, and where he states in his application that he proposes to make sirup only in his own factory, having the sirup thus made by him under his license

manufactured into sugar at a central factory for his account, he retaining the ownership thereof and paying toll for the manufacture, the owner of such central factory shall not be authorized to
224 manufacture for the sugar producer until he has complied with the following requirements:

The owner of such central factory shall file with the internal revenue collector of the district a notice in duplicate stating the business to be carried on and giving a description of the machinery and method of manufacture, with an estimate of the amount of sugar proposed to be made for licensed producers, on form No. 287, the same as is required in the case of applicants for license, one copy to be retained by the collector and the other to be forwarded by the collector to the Commissioner of Internal Revenue. The owner of such central factory shall also file with the said notice and statement a declaration submitting all the operations of the factory to the supervision and control of the Internal-Revenue Bureau.

The owner of such central factory shall, before beginning operations, notify the internal revenue collector of the district, and such factory shall be inspected and be under the control of the Commissioner of Internal Revenue, and subject in all respect- to the rules and regulations prescribed by the Treasury Department in the case of sugar producers. Such central factory shall be treated and considered as a part of the sugar factory of the licensed sugar producer and shall be subject at all times to inspection by internal revenue officers. The owner shall keep the books required of sugar producers, showing from whom sirup has been received for manufacture, the route by which such sirup was received, and the number of gallons of such sirup and its density. The said book shall also show the time, place, and manner of shipment of said sirup, and contain all the items in regard to the production and shipment of sugar and molasses required to be entered by the sugar producer in his book, kept according to the prescribed form, No. 295. The owner of the central factory shall keep this book as nearly as may be according to the form prescribed for producers of sugar from sorghum or sugar cane (form No. 295), making such changes in the headings of columns as may be necessary to comply with the foregoing regulations.

Such central factory shall not be used in refining imported or bounty paid sugars during the period that it is being operated for licensed producers.

A failure on the part of the owner of such central factory to comply with these requirements will be sufficient cause for withholding bounty on the sugar produced.

The owner of such central factory manufacturing sugars for others only and not owning any of the sugar manufactured at such factory and not being entitled to the bounty thereon will not be required to furnish a bond or procure a license.

Refining sugar at the place of production.

The law provides that no bounty shall be paid to any person engaged in refining sugars which have been imported into the
225 United States or produced in the United States upon which the bounty has already been paid or applied for.

It further provides a severe penalty for refining sugar imported into the United States or upon which the bounty has been paid or applied for at the place described in the license.

A sugar producer can refine his own product on his factory premises when the refining is done as a continuous process. Then it is a part of the process of manufacture, and the bounty is payable on the refined product.

If the sugar is not refined in this way as a part of the original process, the refining must be carried on at a separate place.

If a sugar producer desires to refine his product and engage in refining sugars generally, the building used for refining must be located on separate premises from the sugar factory. There shall be considerable distance intervening between the sugar factory and the building where the refining is carried on, the distance to be determined by the circumstances of each case.

The buildings must be entirely distinct, with no communication between them by any covered passageways, tramways or shutes. This will not be held to prevent the conveyance of steam power to the refinery from the adjoining premises.

If the refinery is on premises adjoining the factory, there must be no refining of foreign sugars carried on during the time the sugar factory is in operation, and no foreign sugars must be received upon the premises until the sugar factory has closed operations.

The sugar producer or other person intending to establish a refining establishment on premises adjoining the place described in the license issued by the Commissioner for the manufacture of sugar must furnish this office with an accurate plan and description, in duplicate, of the buildings and premises of the factory and of the proposed refinery, showing the size of the buildings, the distance between them, the machinery connection, and the place where the sugar will be stored before and after being refined, which copies shall be furnished the collector of internal revenue. The accuracy of the plan and description must be verified by the draftsman and the sugar producer.

One of said plans is to be kept by the collector and the other transmitted to the Commissioner of Internal Revenue.

Authority must first be obtained from the Commissioner to establish such refinery if the building is to be located upon the same plantation as the factory, or premises adjoining, and such refinery shall be under the supervision of internal revenue officers in like manner as the factory. Access to the building or buildings used for refining or storing the sugar shall be furnished to the proper officers, and the books showing the operations of the refinery shall be open to their inspection at all times, and it shall be the duty of the refiner, on demand of any internal revenue officer, to furnish a

true and complete statement verified by oath, of the receipts
226 of sugar, with the name and residence of the person from whom the sugar was received, and of all his sales of sugar, with the name and residence, in each instance, of the person to whom it is sold and the place to which it is shipped.

Weighing sugar. Deputy collectors to be assigned to duty as weighers.

Collectors of internal revenue will appoint and commission as deputy collectors a sufficient number of suitable and competent persons to weigh and mark packages of sugar at the place of production or at the designated places for weighing, to be compensated for their services by such allowances as shall have been previously made by the Secretary of the Treasury, upon the recommendation of the Commissioner of Internal Revenue.

For this purpose each collector in whose district sugar is manufactured will, prior to the date when such deputies will be needed, forward to this office a detailed estimate of the number of persons that, in his opinion, will be required, the length of time they will be on duty, the rate of compensation to be paid, and the amount of expenses they will necessarily incur in traveling from one place of duty to another.

Such deputies will be paid by the collector monthly on form 63½, as in other cases, and the amount needed therefor shall be included in the collector's monthly estimate on form 42, after he has been notified of the allowance for this purpose.

They must take the prescribed oath before entering upon duty, and give bonds in such an amount as the collector may require, conditioned that they will faithfully perform the duties of their office. They will be entitled to compensation only for the time they are actually employed in the performance of official duties.

Persons appointed to this office should inform themselves fully respecting the duties thereof before commencing work. They must not be interested, directly or indirectly, in buying or selling sugar, or in the production thereof.

The collector will be held responsible for any loss to the Government arising from the default or wrongful act of such deputies to the same extent that he is liable for the acts of his other deputies, and will exercise the same control over them that he has over any other of his deputies.

Collectors will make a report to the Commissioner every month at the close of the month, giving the names of all persons appointed and on duty as deputy collectors and weighers in his district with date of appointment, the number of days they were on duty, and the quantity of sugar weighed by each, with the number and kind of packages.

227 Duties of weighers.

It will be the duty of deputy collectors assigned to duty as weighers under the instructions and directions of the collector to weigh each package of sugar upon which bounty is to be claimed, and mark upon it its gross weight, tare, and net weight; to mark the pack-

ages with their name and title, and district; to indicate the packages from which samples are to be taken; to keep an accurate account of the packages weighed, and the weight of each, and the packages sampled, and the producer's name, and to report their action on the prescribed form.

The weigher at the time of weighing the sugar will mark in a durable manner in plain figures on the head of each package, unless the same have been correctly marked thereon by the producer, the gross weight, tare, and net weight.

Each weigher will also mark the packages weighed with his name, title, and district.

When the sugar is put in bags the bags must be marked in the same manner as wooden packages as far as practicable.

The marking of packages may be done by a person other than the weigher, under the direct personal supervision of the weigher, but the handling of the beam and taking of weights must be done by himself.

Weighing instruments.

Weighers will be furnished through the collector with the necessary implements for weighing and marking packages.

Each weigher must have his weighing instruments tested and compared with the United States standard at least once a year at the commencement of the sugar season, and as often as may be necessary to keep the same in conformity to the United States standard, and all scales used for weighing sugar for bounty purposes must be so tested.

Weighers will be held responsible for the proper care and safekeeping of the implements in their possession.

Collectors will make requisition to this office promptly for the scales, beams, weights, and other weighing apparatus required in their respective districts.

Tare.

In the case of open kettle sugar in hogsheads the net weight will be ascertained by deducting twelve (12) per cent. for tare from the gross weight.

Whenever a weigher has reason to believe that the actual tare is greater than the tare according to this rule he will empty as many hogsheads as may be necessary, and weigh the same, to ascertain the actual tare.

228 In the case of sugar in barrels or bags or of centrifugal sugar packed in hogsheads, actual tare shall be taken. The empty packages must be weighed by the sugar producer before the sugar is put up and the weight of the packages marked thereon.

The weigher shall from time to time and as often as necessary verify these figures, and empty as many packages as may be necessary, and weigh the same, to ascertain the actual tare.

In the case of open kettle sugar put up in barrels, the actual tare of the packages shall be taken—that is, the packages must be weighed before they are filled, and weighed after they are filled.

In computing tare, if the fraction is one-half pound or over it shall be called one pound; and if less than one-half it shall be disregarded.

In the case of hogsheads of sugar partly filled, the net weight will be ascertained by deducting the average tare of the full packages of the lot.

Whenever the weigher finds packages broken, wet, muddy, or for any cause not in proper condition, he will, unless the same are put in proper condition, report the fact to the collector or deputy in charge, who will, after investigation, direct what allowance shall be made for tare, and such directions, in writing, shall be filed with the weigher's return which is transmitted to the Commissioner of Internal Revenue.

Weighers' books and returns.

Weighers will be furnished by collectors with proper blank books (Book No. 74), in which they are required to make true and correct entries of sugar weighed at the time of weighing.

The books must be kept in such manner that they will contain all the specifications necessary to a complete account of the sugar weighed.

The weigher must enter therein the name of the producer, the serial number of the package, the gross weight, tare, and net weight of each separate package, and totals of each lot, the number of the lot, the quality or grade of the sugar, the date of weighing, and number of his return. He must add the number of packages and weights in each column of his book, and enter totals at the foot of each column, and at the end of the entries make a recapitulation of the total number of packages, gross weights, tare and net weights of each lot. The book must be kept so as to show the number of packages weighed each day.

A certificate must be made at the end of the entries showing that it is the official record of the weigher, and his signature should be attached.

The book must then be delivered to the collector for examination and file. The collector will carefully examine the weigher's books before filing, and verify the computations to satisfy himself that they are correct.

229 In the case of sugar packed in hogsheads the weighers may omit to mark upon each hogshead and to enter in their Book No. 74 the tare and net weights; and they may mark and enter only the gross weights of the packages.

The weighers will enter in Book No. 74 the aggregate gross weights, the tare and the net weight of each lot.

Weighers will make returns in triplicate on the prescribed form, giving the aggregate of sugar weighed for each producer, the three copies to be delivered to the collector of internal revenue. The collector will examine these returns carefully upon their receipt and compare them with the detailed record of sugar weighed—Book No. 74. If found to be correct they will be delivered to the inspector who is to make the classification. After the inspector has made his report on the prescribed form attached to the weigher's return, the collector will transmit one copy to the Commissioner of Internal Revenue, retain one on his files, and deliver one to the sugar producer or his agent. The weigher's returns, form No. 316, with the weigher's books, will be sent directly through the proper channel to

the classifying inspector at the same time with the sample of the lot or lots described in the returns. Each weigher must number his returns consecutively, commencing each season with No. 1.

The collector can direct the weigher to turn over his returns and the weigher's book directly to the inspector or other officer who is to make the classification when, in the opinion of the collector, the circumstances render such action advisable or more likely to facilitate operations, and in such cases the inspector will complete the papers by adding his report and deliver all the papers to the collector.

Weighing sugar at designated central places.

The sugar will be weighed by weighers stationed at such central places as may be designated by the Commissioner of Internal Revenue or at the place of production by resident weighers or weighers located in the vicinity. Collectors will notify sugar producers where weighers are to be stationed and where sugars may be sent to be weighed and inspected.

If the sugar producer intends to ship sugar to a designated central place where a weigher is stationed he will give notice to the collector of internal revenue stating his intention to do so, in what manner and to whom, specifying the kind and number of packages, the number of the lot, the serial numbers, the marks, the kind of sugar, and the weight, if it has been weighed.

This notice may be written or printed, and may be in the following form:

230 *Sugar Producer's Notice of Intention to Ship Sugar, and Application for Weighing and Inspection.**

——— ———, 189–.

To ——— ———, Esq., collector internal revenue.

SIR: You are hereby notified that the following described packages of sugar produced by me at my factory, license No. —, upon which bounty will be claimed, are intended to be shipped to ——— on board the ———, at ———, consigned to ——— ———, on the — day of ———, 189–, and I request that the same may be weighed and inspected upon notice of the consignee of its arrival.

Kind and number of packages.	Kind of sugar.	No. of lot and serial Nos.	Weight.		Remarks (polarization, if polarized).
			Gross.	Net.	
			Lbs.	*Lbs.*	

——— ———,
Sugar Producer.

NOTE.—If shipment is to be by cars, give name of railroad company and route by steamer, give the name.

Under the heading "Kind of sugar" will be given not only the commercial designation of each kind of sugar, but also the designation based on the mode of manufacture, as "open kettle," "firsts," "granulated seconds," "seconds," etc.

When the sugar has arrived at its destination the consignee shall immediately notify the collector and furnish him with a copy of the bill of lading.

231 The notice shall specify the packages as shown by the serial numbers and marks, and shall be in the following form:

Form 299.

United States Internal Revenue.

Consignee's Notice of Arrival of Sugar, and Application for Weighing and Testing.

(Bill of lading to be inclosed.)

—— ——, 189–.

To —— ——, Esq., collector of internal revenue, — dist. of ——.

SIR: You are hereby notified that the following described packages of sugar, upon which bounty is to be claimed, produced by —— ——, license No. —, at his factory, at —— plantation, —— parish, were shipped on the — day of ——, 189–, on board the —— from —— according to the inclosed bill of lading, dated ——, 189–, consigned to me, and having been received at ——, and I request that the same may be weighed and inspected.

Kind and number of packages.	Kind of sugar.	Reported net weight, pounds.	Marks.	No. of lots.	Serial Nos.	Remarks.

—— ——, *Consignee.*

* This office does not furnish any printed forms for this notice.

Upon receipt of the application of the producer and the consignee's notice of arrival of the sugar, the collector will issue an order to the weigher directing him to weigh and mark the packages therein described, delivering to the weigher the notice of the consignee, which order will be in the following form:

232 *Collector's Instructions to Deputy Collector to Weigh Sugar at Central Place.*

(To be returned to collector and filed with the weigher's report.)

Office of collector of internal revenue, — district of ——,——, 189–.

To —— ——, deputy collector:

You will proceed to weigh and mark, according to the regulations, — packages of sugar produced by —— —— of —— plantation, license No. —, shipped by him to *—— ——, and described as follows in bill of lading dated ——, 189–, and notice of consignee, dated ——, 189–.

Samples for determining the classification will be taken at the time of weighing.

You will make your return on the prescribed form with these instructions attached thereto.

Kind and number of packages.	Kind of sugar.	No. of lot.	Serial numbers.	Remarks.

—— ——, *Collector.*

Upon the receipt of this notice, the weigher will proceed to make an examination of the packages and see that they are identical with those named in the notice of the consignee. He will also make the necessary examination to see that the packages have been properly marked by the producer and that everything is regular. Any irregularity will be reported to the collector.

He will weigh each package separately and ascertain the gross weight, tare, and net weight, and mark the packages as required by the regulations, reporting his action on the prescribed form in triplicate.

Weighing sugar at the place of production.

The collector will be authorized to locate weighers at as many convenient points in his district as he may deem necessary, subject to the approval of the commissioner, to weigh sugar at the place of production.

Deputy collectors will be designated by the collector for this duty with reference to the convenience of producers and the prompt and economical performance of the work.

* Here insert name of consignee.

233 1. When there is no weigher stationed at the factory.

If the sugar producer does not desire to ship the sugar to a central place where a weigher is located, but desires to remove it from the factory for shipment to other points, or for sale at local points, or for consumption, or for storage in a warehouse, in case there is no weigher stationed at the factory, he will make application to the collector or division deputy collector, or the deputy collector assigned to duty as weigher in the division in which his factory is located, to have it weighed at the place of production.

Such applications will be made in duplicate, one copy to be forwarded to the collector with the weigher's return and the other retained by the weigher.

The application should be in the following form:

Form 300.

United States Internal Revenue.

Sugar Producer's Notice and Application for Weighing Sugar at Factory.

(To be made in duplicate.)

—— —, 189–.

To —— ——, Esq., collector internal revenue.

SIR: You are hereby notified that the following-described packages of sugar produced by*—— ——, —— postoffice, —— parish at —— plantation, at factory license No. —, upon which bounty will be claimed, are intended to be removed from the factory for †——, and I request that the same may be weighed and inspected at the factory.

Kind and number of packages.	Kind of sugar.	No. of lot.	Serial Nos.	‡ Weight.		Remarks.
				Gross.	Net.	
				lbs.	*lbs.*	

——— ———,
Sugar Producer.

* In case of a firm state name of firm.

† For shipment to ——, for storage at ——, or for consumption, as the case may be.

‡ If the sugar has not been weighed this column can be left blank.

234 The collector's order to the weigher will be in the following form:

Collector's Instructions to Deputy Collector to Weigh Sugar at the Factory.

(To be returned to the collector and filed with the weigher's report.)

Office of collector of internal revenue, — district of ——, ——, 189–.

To —— ——, deputy collector.

SIR: You will proceed to the factory of —— ——, at —— plantation, and examine, weigh, sample, and mark, according to the regulations, — packages of sugar produced by him and intended to be removed for —— and described as follows in his notice dated ——, and make your return in triplicate on the prescribed form attached to this order:

Kind and number of packages.	Kind of sugar.	No. of lot.	Serial Nos.	Reported net weight, pounds.	Remarks.

—— ——, *Collector.*

Upon the receipt of this order, the officer will proceed to the factory and weigh, sample, and mark the packages, after making such examination as may be necessary to identify the packages with those described in the sugar producer's notice, and to satisfy himself that the requirements of the regulations have been complied with, reporting on the prescribed form as in the case of sugar weighed at a central place.

2. When a weigher is stationed at the factory.

If there is an officer stationed at the factory to weigh sugar, no written or printed notice of intended shipment or application for weighing is required. Such officer will weigh the sugar whenever it is to be removed from the factory, making reports on the day of weighing on the prescribed form.

Such officer will be furnished by the sugar producer with duplicates of all bills of lading, which he will forward to the collector of internal revenue.

He will also see that the producer states the correct weight of empty packages; and if he has reason to believe that this is
235 not the case he will empty a sufficient number and ascertain their weight, or oversee the weighing of the empty packages.

This officer is required to carefully observe the operations of the factory, and if any irregularity or violations of the regulations is observed, to report the same to his superior officer or to the collector of the district.

Sampling sugar and its classification.

1. Sampling at central place.

Samples must be taken at the time of weighing by a deputy collector or other officer acting under instructions of the collector.

The weigher and sampler will act in coöperation, and the serial numbers of the packages from which samples are taken will be indicated by the weigher on his book, form 74.

Of open kettle or other sugars packed in hogsheads, belonging to the same lot, 50 per cent., or every other package, shall be sampled. Of centrifugal sugars packed in barrels, if "second" or "third" sugar, or any sugar not grained in a vacuum strike pan, 25 per cent., or every fourth package, shall be sampled; if "first" or "cut second" sugar, 10 per cent., or every tenth package, shall be sampled, unless the lot contains less than ten packages, when 25 per cent., or every fourth package shall be sampled. Of sugar packed in bags, 5 per cent., or every twentieth package shall be sampled.

The collector will indicate in writing on the order to the weigher what packages are to be sampled, whether even or odd numbers, as follows: "Sample 25 per cent., alternate even (or odd) numbers;" "Sample 50 per cent., even (or odd) numbers," as the case may be, the collector varying the order in his discretion.

The sample packages shall be selected in regular order as numbered, as, for example, when 25 per cent. is to be sampled, serial Nos. —2—6—10, etc., or Nos. —1—5—9, etc., will be taken, according as the alternate even or odd numbers are designated by the collector. When 50 per cent. is to be sampled, serial Nos. —2—4—6, or Nos. 1—3—5, etc., will be taken, according as the even or odd numbers are designated by the collector.

Samples will be drawn from the packages by means of triers. The form of instrument and the manner of using the same will be prescribed, from time to time, by the Commissioner of Internal Revenue, and will vary according to the nature of the package and the character of the sugar.

The samples as drawn shall be placed in the tin boxes provided for this purpose, each box being entirely filled, except in case of dry or "first" sugar in lots exceeding 50 barrels.

In lots exceeding 50 barrels of "first" sugar, only one short trier full from each barrel sampled need be taken. In lots of 50 barrels or less, enough sugar shall be taken from each barrel sampled to fill a tin sample box.

236 The boxes will be properly labeled for identification and conveyed to the examination room in chests securely locked.

In cases where only the samples from the same lot of sugar are placed in one chest and the chest is properly labeled, it will not be

necessary to label each tin sample box. Where the chest contains samples of more than one lot, each box must be properly labeled for identification. The weigher will deliver the chest containing the samples of the sugar weighed to the classifying inspector, and at the time of such delivery he will hand him the triplicate returns, form No. 316, and the weigher's book covering the lot represented by the samples contained in the chest. The inspector will not receive the samples without the returns and books, nor the books without the samples of the sugar covered by the same. When the weigher delivers a chest of samples and the returns relating to the same, he will not leave the examining or classification room until the samples and returns have been so checked as to satisfy the inspector that the chest contains only the samples of the sugar described in the returns, and in case the returns and weigher's book do not seem to correspond with the contents of the chest the inspector will decline to receive the papers and samples and immediately report the fact to the collector or proper revenue agent.

The samples will be examined as soon as possible after reaching the examining or classification room, and to this end all the samples from the different packages of each lot will be mixed thoroughly, and the classification based upon the general sample thus obtained.

The classification of the sugar will be made by the inspector in charge of the examining or classification room.

A polariscopic test will not be necessary in all cases in order to determine the classification. In many cases the inspector will be able to decide that certain sugars of a high grade will test over 90° without using a polariscope.

All "second" or "third" sugars, including all sugar allowed to grain in wagons, as well as all "open kettle" sugar, and sugar made in any other way than in a vacuum strike pan, will be subjected to a polariscopic test and classified according to the indication of its saccharine strength as obtained thereby.

Whenever there is, from any reason whatsoever, any doubt in regard to a sample of high grade sugar polarizing 90 per cent. or more, a polariscopic test shall be made and the classification based upon the result of the test.

If it is decided that a polariscopic test shall be made, two of the tin sample boxes shall be filled with it, properly labeled, and one sample shall be transmitted to the laboratory for test with as little delay as possible, and one sample will be held in the examining room until the final classification is determined.

The polariscopic tests shall be made in duplicate only in cases where a single analysis gives a result which falls within the following limits, viz., less than 92 degrees and more than 88 degrees or less than 83 degrees. In such cases another test shall be made
237 by a different expert. In case the results of the two separate tests agree within three-tenths of a degree (3 per cent.) the average of the two shall be accepted as the basis of classification. In case the results do not agree within three-tenths of a degree (.3 per cent.) a third test of the sample shall be made, and of the three

tests thus made, the average of the two most closely agreeing shall be accepted as the basis of classification, *provided* the said last-mentioned tests agree within three-tenths of a degree (.3 per cent.)

When two of the three tests thus made do not agree within three-tenths of a degree (.3 per cent.) a fourth test of the samples shall be made, which shall be subject to the same provisions as hereinbefore stated with reference to the preceding tests.

Laboratories will be established at all central places where sugar is weighed, and samples of sugar which require a polariscopic test to determine their classification will be tested by experts in the use of the polariscope. The officer in charge of the laboratory shall report the polariscopic tests to the inspector in charge of the examining room on the prescribed form (Book No. 76).

The inspector will report on form No. 317, in triplicate, the three copies to be delivered to the collector of internal revenue, one copy to be sent by the collector to the Commissioner of Internal Revenue, one to be retained by the collector, and one delivered to the sugar producer, or his agent.

He will also keep a record, Book 77, showing the producer's name, number of lot, etc., for each sample of sugar, the date of inspection and the polariscopic tests.

2. Sampling at place of production.

When the weighing and inspection of sugar is performed at a factory where a weigher is stationed, samples will be taken by him in the sugar bin or mixing room before the sugar is barreled. Such officer will, after he has ascertained that a lot of sugar has been thoroughly mixed, and that it is of a uniform grade, either all from one "strike" or from not more than three different "strikes" of first, second, or third sugar, as the case may be, obtain a general sample representing the entire lot or heap of sugar by taking from three to five separate portions of about a pound each from different parts of a heap, drawing them from below the general surface of the heap. These portions will be mixed together, and two sample boxes filled with the general samples thus obtained. These boxes will be properly numbered and labeled, one used by the officer to determine the proper classification of the sugar, and one kept under seal at the factory. The sample will cover all the sugar in the lot or heap, and the officer will enter it upon his books in connection with the packages in which the sugar is packed, taking proper care to make certain that this sugar and no other is placed in the packages included in the lot.

238 Especial care shall be taken in sampling low-grade sugars, "wagon sugars," "third sugars," etc., in order to obtain a representative sample, and the officer may insist upon a thorough mixing of the sugar in the bin before drawing the sample. If, for any reason, it is impracticable to sample in the bin, or if the mixing is not done to the satisfaction of the weigher, he may take samples from the packages while they are being filled. To do this the same quantity shall be taken from each package and placed in a covered

receptacle. When all the packages in a lot have been sampled in this way, the whole should be thoroughly mixed and a general sample obtained to represent the lot, from which the two sample boxes will be filled as indicated above.

When the weighing and sampling of sugar is performed at a factory where there is no resident weigher, such officer being deputed to visit the factory for the purpose of weighing and inspecting sugar upon notification of the producer, samples will be taken from the packages after they are packed and weighed in the same manner as prescribed above under the head of "Sampling at central place," using such triers as may be prescribed. The weigher will perform the mixing himself, and fill two sample boxes from the general sample obtained. If it is more convenient, samples may be drawn from the open packages before heading up, and the weigher must not leave the factory until all the packages are headed up.

When sugar is weighed at the place of production, the triplicate daily returns, form No. 316, the weigher's books, and the samples of the lots covered by the same will from day to day be placed in the sample chest and the chest locked, the key remaining in possession of the weigher.

Before forwarding the chest to the collector, the weigher will see that it contains no samples not covered by the proper returns and books, and no returns or books not represented by the proper sample.

When the chest containing samples and returns and books is forwarded, a letter of advice, on form 319, should be forwarded through the mail to the collector, advising him of the shipment, giving the name of the producer, the lot number and the serial numbers of each lot, and means of transportation.

General precautions to be observed in sampling.

Great care will be taken, in all operations connected with the sampling of sugars, to prevent, as far as possible, any drying out of the samples. The samples taken from packages shall be transferred as quickly as possible to the tin sample boxes, and the latter covered immediately. When these samples are mixed for the purpose of obtaining a general sample, the operation shall be rapidly performed, and under conditions that tend to prevent evaporation of moisture, so far as practicable.

239 All samples which are sent by express or mail must be sealed with paraffin, in the manner prescribed below.

Proper judgment will be exercised by weighers stationed at factories in regard to sending samples to the collector. Samples must not be held longer than five days at most. If sufficient have not accumulated in that time to warrant sending a chest by express the weigher may send them by mail to the collector, together with the returns belonging to them.

All operations connected with the sampling of sugar must be performed by the weigher, or under his immediate supervision.

A *lot* comprises a number of packages of sugar which is all of the same grade, so that all may properly be represented by one general sample. Weighers must see that these conditions are fulfilled, and

make such subdivisions as may be necessary to accomplish it. When sugar is sampled at the factory each strike shall constitute a lot, but as many as three strikes of dry sugar may be included in one lot if all are of a uniform grade and are thoroughly mixed in the sugar bin before being packed. If more convenient, lots may be made to cover a certain number of packages, and in this case not more than two hundred barrels or bags of dry sugar shall be included in one lot, and not more than one hundred and fifty barrels or bags of low grade, or "wagon" sugars. Of open-kettle sugar packed in hogsheads not more than fifty shall be included in one lot.

Preservation of samples of sugar.

Whenever samples of sugar are to be kept for any length of time, or transported from one place to another, they must be guarded against loss or gain in moisture. This may be accomplished by pasting a strip of paper around the edge of the top of the tin box containing the sample, in such a manner as to completely cover the joint between the lid and the body of the box. The strip is then to be coated with melted paraffin, in order to prevent the access of air to the contents of the box. Widemouth bottles with ground glass stoppers may be used for the preservation of samples in lieu of the tin box closed with paraffin. When such samples are to be kept under seal, they shall, in addition to being closed air-tight with paraffin, be encircled with string or tape, and the knots sealed with sealing wax, upon which some identifying mark is made while soft.

Sampling instruments and transportation of samples.

Where sugar is weighed and sampled at a central place, the necessary sampling instruments, boxes, chests, etc., will be supplied to collectors upon their requisition made to the Commissioner of Internal Revenue. Where sugar is weighed and sampled at the place of production, the producer must furnish the necessary instruments, boxes, chests, etc., and must bear all the expenses incurred by the weigher in sending the samples to the examining room at whatever place the sugar is classified.

240 Special arrangements for the sampling and classification of sugar.

In the case of isolated factories special arrangements for the sampling and classification of the sugar may be made by the Commissioner of Internal Revenue.

Inspectors.

The Commissioner of Internal Revenue is authorized to appoint twelve inspectors. Their duties, which will be performed under the general direction of the Commissioner, will be to inspect sugar upon which a bounty is claimed, and to aid in ascertaining the amount of bounty due. They will be required also to perform such other duties in connection with the internal-revenue service as the Com-

missioner may direct. They will have general supervision over the weighing of sugar, and taking of samples to determine the classification, and for the polariscopic test.

Inspectors' reports and books.

Inspectors will keep an accurate account of the packages inspected and the marks thereon, the producer's name, and the polariscopic test, and make a report of their action on the prescribed form on the day of inspection, or as soon thereafter as practicable.

Inspectors will keep a record of all sugar inspected in book, form No. 75, which will be furnished by the Commissioner of Internal Revenue. When the book is full, a certificate must be made at the end of the entries showing that it is the official record of the inspector, and his signature shall be attached. The book must then be forwarded to the Commissioner of Internal Revenue to be filed in his office.

Inspectors in charge of the examining or classification room.

The inspector in charge of the classification of sugar will mark upon each return, form No. 317, at the time the sample is examined, the grade of sugar, the date of classification, whether passed upon without a polariscopic test, and if sent to the laboratory for polariscopic test he will mark thereon the laboratory number of the sample and the date of sending it to the laboratory. The classifying inspector will hold all returns, forms 316 and 317, for which no samples have been received until the proper samples are received, and will hold all samples for which no returns have been received until the proper returns have been received. In case of missing samples or return, notice will be immediately given to his chief, who will make immediate demand upon the weigher for the missing return or sample.

241 Proper arrangement of laboratories.

Plans for permanent laboratories for the testing of sugar must be approved by the Commissioner of Internal Revenue. In cases where a temporary laboratory is established, as for example, at a sugar factory during the manufacturing season, the following general directions will be observed, as far as practicable:

The room used for the purpose shall be one that is as far removed as possible from the vibration of machinery; it must be well lighted and have some means of artificial heating, so that the temperature may be controlled, and shall not be too near steam boilers, furnaces, flues, or any source of heat which cannot be controlled. The polariscope shall be placed in the darkest part of the room, and this part of the room may be darkened, if desired, by curtains or hangings. In no case, however, shall the polariscope be entirely separated from the room in which the rest of the work is performed, as the solutions must be made up and polarized at the same temperature. The lamp used for the illumination of the polariscope, on the other hand,

must be separated from the instrument, as its heat tends to increase the temperature of the room and cause it to vary from time to time. The separation of the lamp from the instrument will be best accomplished by means of a board partition, making a separate compartment for the lamp, which may have its own window or opening for ventilation. The partition must be perforated with an opening just large enough for the passage of light to the instrument. If a separate compartment for the lamp cannot be made, a wooden screen may be used, perforated in a proper manner, and placed on the table between the instrument and the lamp.

The table upon which the polariscope stands must be level, and the instrument itself must not be near any source of heat, and must not be exposed to the direct rays of the sun.

Instructions Relative to the Use of the Polariscope in Testing Sugar upon which a Bounty is to be Claimed.

Definition of the word "degree" as it occur- in the act.

The expression "testing * * * *degrees* by the polariscope," occurring in paragraph 231 of the act, is construed to mean the *percentage* of pure sucrose contained in the sugar, as ascertained by polarimetric estimation. Until further notice the degree of the "Ventzke scale," as hereinafter defined, will be considered as indicating the correct percentage of sucrose, in the form of instrument used by this office in testing sugar. The "Ventzke scale" is hereby defined to be such that *one degree of the scale is the one-hundredth part of the rotation produced in the plane of polarization of white light in a column* 200 *millimetres long, by a standard solution of chemically pure sucrose at* 17.5° *C. The standard solution of sucrose in*
242 *distilled water being such as to contain, at* 17.5° *C. in* 100 *cubic centimeters,* 26.048 *grams of sucrose.*

In this definition the weights and volumes are to be considered as *absolute,* all weighings being referred to a vacuum.

Directions for the polarization of sugar.

The following directions for the use of the polariscope in testing sugar are based upon the recommendations in a report made to the Commissioner of Internal Revenue by a commission consisting of the chemist of internal revenue, the chief chemist of the Department of Agriculture, and the assistant in charge of weights and measures, Coast and Geodetic Survey. The prescribed course of procedure will be closely adhered to in all tests of sugar under the provisions of law relative to bounty.

Description of instrument and manner of using.

The instrument employed is known as the half shadow apparatus of Schmidt and Haensch. It is shown in the following cut:

Fig. 1.

The tube N contains the illuminating system of lenses and is placed next to the lamp; the polarizing prism is at O, and the analyzing prism at H. The quartz wedge compensating system is contained in the portions of the tube marked F, E, G, and is controlled by the milled head M. The tube J carries a small telescope, through which the field of the instrument is viewed, and just above is the reading tube K, which is provided with a mirror and magnifying lens for reading the scale.

The tube containing the sugar solution is shown in position in the trough between the two ends of the instrument. In using the instrument the lamp is placed at a distance of a least 200^{mm} from the end; the observer seats himself at the opposite end in such
243 a manner as to bring his eye in line with the tube J. The telescope is moved in or out until the proper focus is secured so as to give a clearly defined image, when the field of the instrument will appear as a round, luminous disk, divided into two halves by a vertical line passing through its center, and darker on one-half of the disk than on the other. If the observer, still looking through the telescope, will now grasp the milled head M and rotate it first one way and then the other, he will find that the appearance of the field changes, and at a certain point the dark half becomes light and the light half dark. By rotating the milled head delicately backwards and forward over this point he will be able to find the exact position of the quartz wedge operated by it, in which the field is neutral, or of the same intensity of light on both halves. The three

different appearances presented by the field are best shown in the following diagram:

Fig. 2.

With the milled head set at the point which gives the appearance of the middle disk as shown above, the eye of the observer is raised to the reading tube K, and the position of the scale is noted. It will be seen that the scale proper is attached to the quartz wedge, which is moved by the milled head; and attached to the other quartz wedge is a small scale called a *vernier*, which is fixed, and which serves for the exact determination of the position of the movable scale with reference to it. On each side of the zero line of the vernier a space corresponding to *nine* divisions of the movable scale is divided into *ten* equal parts. By this device the fractional part of a degree indicated by the position of the zero line is ascertained in tenths; it is only necessary to count from zero, until a line is found which makes a continuous line with one on the movable scale.

With the neutral field, as indicated above, the zero of the movable scale should correspond closely with the zero of the ve-nier, unless the zero point is out of adjustment.

If the observer desires to secure an *exact* adjustment of the zero of the scale, or in any case if the latter deviates more then one half of a degree, the zero lines are made to coincide by moving the milled head and securing a neutral field at this point by means of the small key which comes with the instrument, and which fits a small nipple on the *left*-hand side of F, the fixed quartz wedge of the compensating system. This nipple must not be confounded with a similar nipple on the *right*-hand side of the analyzing prism H, which it fits as well, but which *must never be touched*, as the adjustment of the instrument would be seriously disturbed by moving it. With the key on the proper nipple it is turned one way
244 or the other until the field is neutral. Unless the deviation of the zero be greater than .5 degree it will not be necessary to use the key, but only to note the amount of the deviation, and for this purpose the observer must not be content with a single setting, but must perform the operation five or six times and take the meaning of these different readings. If one or more of the readings show a deviation of more than .3 degree from the general average they should be rejected as incorrect. Between each observation the eye should be allowed 10 or 20 seconds of rest.

The "setting" of the zero having been performed as above, the determination of the accurate adjustment of the instrument by means of the "control" quartz plates is proceeded with. Such a plate will be furnished with each polariscope, having a sugar value which varies with the temperature, and tables are furnished each which give its exact value at different temperatures from 10° to 35° C.

The plate is placed in the instrument and the field observed; it will be seen that the uniform appearance of the field is changed. The milled head is turned to the right until the exact point of neutrality is reestablished, just as described above in setting the zero. The scale is read, the observation repeated, the reading taken again, and so on until five or six readings have been made. The average is taken, readings being rejected which show a divergence of more than .3, and the result corrected for the deviation of the zero point, if any was found, the deviation being added if it was to the left and subtracted if to the right. If the adjustment of the instrument be correct the result should be the value of the control plate used, as ascertained from the table, for the temperature of 20° C. A variation of .3 from the established values may be allowed for errors of observation, temperature, etc., but in the hands of a careful observer *a deviation greater than this after a careful setting of the zero shows that the instrument is not accurately adjusted.*

After the adjustment of the instrument the setting of the zero point is dispensed with, the indication of the scale for sugar solutions being corrected by the amount of deviation shown in the reading of the control plate from its established value as ascertained from the table, at the temperature of the room.

For example: A sugar solution polarizes 80.5; the control plate just before had given a polarization of 91.4, the temperature of the room during both observations being 25° C. According to the table the value of the control plate at 25° C. is 91.7; the reading is therefore .3 too low, and .3 is added to the reading of the sugar solution, making the corrected result 80.8. The temperature of the room must be ascertained from a standardized thermometer placed close to the instrument and in such a position as to be subject to the same conditions.

245 Preparation of the sugar solution for polarization.

If the sample is not entirely uniform it must be thoroughly mixed before weighing out, after all the lumps are broken up, best with a mortar and pestle. Then 26.048 grams are weighed out on the balance in the tared German silver dish furnished for this purpose. Care must be taken that the operation- for mixing and weighing out are not unduly prolonged, otherwise the sample may easily suffer considerable loss of moisture, especially in a warm room. The portion of sugar weighed out is washed by means of a jet from a wash bottle into a 100cc flask, the dish being well rinsed three or four times and the rinsings added to the contents of the flask. The water used must be either distilled water or clear water which has been found to have no optical activity. After the dish has been thoroughly rinsed, enough water is added to bring the contents of the flask to about 80cc, and it is gently rotated until all the sugar has dissolved. The flask should be held by the neck with the thumb and finger, and the bulb not handled during this operation. Care must be taken that no particle of the sugar or solution is lost. To determine if all the sugar is dissolved, the flask is held above the

level of the eye, in which position any undissolved crystals can be easily seen at the bottom. The character of the solution is now observed. If it be colorless or of a very light straw color, and not opalescent, so that it will give a clear, transparent liquid on filtration through paper, the volume is made up directly with water to the 100cc mark on the flask. Most sugar solutions, however, will require the addition of a clarifying or decolorizing agent in order to render them sufficiently clear and colorless to polarize. In such case, before making up to the mark, a *saturated* solution of subacetate of lead is added.

The quantity of this agent required will vary according to the quality of the sugar; for sugar which has been grained in the strike pan and washed in the centrifugals, from 3 to 15 drops will be required for sugar grained in the strike pan, but not well washed in the centrifugals, that is, sugar intended for refining purposes, from 15 to 30 drops will be required; for sugar not grained in the strike pan, that is, "wagon" or "string sugar," "open kettle sugar," etc., from 1 to 3cc will be required. After adding the solution of subacetate of lead the flask must be gently shaken, so as to mix it with the sugar solution. If the proper amount has been added, the precipitate will usually subside rapidly, but if not the operator may judge of the completeness of the precipitation by holding the flask above the level of the eye and allowing an additional drop of subacetate of lead to flow down the side of the flask into the solution; if this drop leaves a clear track along the glass through the solution it indicates that the precipitation is complete; if on the other hand, all trace of the drop is lost on entering the solution, it indicates that an additional small quantity of the subacetate of lead is required.

246 The operator must learn by experience the point where the addition should cease; *a decided excess of subacetate of lead solution should never be used.*

The use of subacetate of lead should, in all cases, be followed by the addition of "alumina cream" (aluminic hydrate suspended in water),* in about double the volume of the subacetate solution used, for the purpose of completing the clarification, precipitating excess of lead, and facilitating filtration. In many cases of high grade sugars, especially beet sugars, the use of alumina alone may be sufficient for clarification without the previous addition of subacetate of lead.

The solution is now made up to the mark by the addition of distilled water in the following manner: The flask, grasped by the neck, between the thumb and finger, is held before the operator in an upright position, so that the mark is at the level of the eye, and

*Prepared as follows: Shake up powdered commercial alum with water at ordinary temperatures until a saturated solution is obtained. Set aside a little of the solution, and to the residue add ammonia, little by little, stirring between additions, until the mixture is alkaline to litmus paper. Then drop in additions of the portions left aside, until the mixture is just acid to litmus paper. By this procedure a cream of aluminum hydroxide is obtained suspended in a solution of ammonium sulphate, the presence of which is not at all detrimental for sugar work when added after subacetate of lead, the ammonium sulphate precipitating whatever excess of lead may be present.

water is added, drop by drop, from a siphon bottle or wash bottle, until the lowest point of the curve or meniscus formed by the surface of the liquid just touches the mark. If bubbles hinder the operation, they may be broken up by adding a single drop of ether, or a spray from an ether atomizer, before making up to the mark. The mouth of the flask is now tightly closed with the thumb, and the contents of the flask are thoroughly mixed by turning and shaking. The entire solution is now poured upon the filter, using for this purpose a funnel large enough to contain all the 100^{cc} at once, and a watch glass is placed over the funnel during filtration to prevent a concentration of the solution by evaporation.

The funnel and the vessel used to receive the filtrate must be perfectly dry. The first portion of the filtrate, about 20 to 30^{cc}, should be rejected entirely, as its concentration may be affected by a previous hygroscopic moisture content of the filter paper. It may also be necessary to return subsequent portions to the filter until the liquid passes through perfectly clear.

If a satisfactory clarification has not been obtained, the entire operation must be repeated, since *only with solutions that are entirely clear and bright can accurate polarimetric observations be made.*

When a sufficient quantity of the clear liquid has passed through the filter, the 200^{mm} observation tube is filled with it. The 100^{mm} tube should never be used except in the rare cases, when, notwithstanding all the means used to effect the proper decolorization of the solution, it is still too dark to polarize in the 200^{mm} tube. In such cases the shorter tube may be used, and its reading multiplied by two. The zero deviation must then be determined and applied to the product. This will give the reading which would have been obtained if a 200^{mm} tube could have been used, and it only remains to apply the correction determined by the use of the control plate as previously described.

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Example:

Solution reads in 100mm tube	47.0
Multiplied by 2	2.0
Product	94.0
Zero reads plus 0.3	0.3
Solution would read in 200mm tube	93.7
Reading of control plate	90.4
Sugar value of control plate	90.5
Instrument too low by	0.1
Add 0.1 to	93.7
Correct polarization of solution	93.8

Before filling the tube it must either be thoroughly dried by pushing a plug of filter paper through it, or it must be rinsed several

times with the solution itself. The cover glasses must also be clean and dry and without serious defects or scratches. Unnecessary warming of the tube by the hands during the filling should be avoided; it is closed at one end with the screw cap and cover glass, and grasped by the other end with the thumb and finger. The solution is poured in until its curved surface projects slightly above the opening, the air bubbles allowed time to rise, and the cover glass pushed horizontally over the end of the tube in such a manner that the excess of liquid is carried over the side, leaving the cover glass exactly closing the tube with no air bubbles beneath it, and with no portion of the liquid upon its upper surface. If this result is not attained the operation must be repeated, the cover glass being rubbed clean and dry, and the solution again brought up over the end by adding a few more drops. The cover glass being in position, the tube is closed by screwing on the cap. The greatest care must be observed in screwing down the caps that they do not press t tightly upon the cover glasses; by such pressure the glasses themselves may become optically active, and cause erroneous readings when placed in the instrument. It must therefore be ascertained that the rubber washers are in position over the cover glasses, and the caps should be screwed on lightly. It must also be re-
248 membered that a cover glass, once compressed, may part with its acquired optical activity very slowly, and some time must be allowed to elapse before it is used again.

The polariscopic reading may now be taken, an observation on the control plate having been made immediately before, as previously described. Then, *without altering the position of the instrument relative to the light, or changing the character of the latter in any way*, the tube filled with the sugar solution is substituted for the control plate. The telescope is adjusted, if necessary, so as to give a sharply defined field, which must appear round and clear. (This condition *must be fulfilled* before the observation is performed, as it is essential to accuracy.) The milled head is turned until the neutral point is found, and the reading is taken exactly as previously described, the operation repeated five or six times, the average taken with the rejection of aberrant readings, the average figure corrected for the deviation shown by the control observation from the sugar value of the control plate at the temperature of observation as given in the table, and the result taken as the polarization of the sugar. When a series of successive polarizations is made under the same conditions as regards temperature, position of the instrument with relation to the light, intensity of the light, etc., the control observation need not be made before each polarization, one such observation being sufficient for the entire series. The control must be repeated at least once an hour, however, and oftener when the operator has reason to think that any of the factors indicated above have been altered, for any such alteration of conditions may change the zero point of the instrument.

In the polarization of the quartz plates, as also in the polarization of very white sugars, difficulty may be experienced in obtaining a complete correspondence of both halves of the field. With

a little practice this may be overcome and the neutral point found, but when it can not the ordinary telescope of the instrument may be replaced by another, which is furnished with the polariscope, and which carries a yellow plate. This removes the difficulty, and renders it possible, even for one not well accustomed to the instrument, to set it at the exact point of neutrality.

Summarized sources of error.

The following principal sources of error must be especially guarded against:

1. Drying out of sample during weighing.
2. Excess of subacetate of lead solution in clarification.
3. Incomplete mixing of solution after making up to mark.
4. Imperfect clarification or filtration.
5. Concentration of solution by evaporation during filtration.
6. Undue compression of the cover glasses.
7. Alteration of the temperature of room, position of instrument, or intensity of light while the observation or control observation is being performed.

249 8. Performance of polarization with a cloudy, dim, or not completely round and sharply defined field.

Standardization and adjustment of apparatus and instruments.

All weights, flasks, polariscope, tubes, and quartz control plates used in the work of testing sugar by the polariscope will be standardized, and their accuracy attested, by the office of weights and measures, U. S. Coast and Geodetic Survey. They will be marked with the name or initials of the office of internal revenue (U. S. I. R.), and no test of sugar for bounty will be made with apparatus which is not so marked, unless special authority is given. Each quartz control plate will be accompanied by a table giving its sugar value at temperatures of each degree centigrade from 10° to 35°, in terms of the Ventzke scale.

The polariscopes used will be marked "U. S. internal revenue polariscope, No. —," and will have their adjustment examined and their accuracy attested by the chemist of the internal revenue office.

Care of instruments and apparatus.

Officers who are charged with the duty of making polariscopic tests will be furnished with the necessary instruments and apparatus, for the proper care of which they will be held responsible. Flasks, funnels, and other glass apparatus will be replaced, when broken, upon application to the Commissioner of Internal Revenue. Officers will be expected to exercise due economy in making requisition for the same, as well as care in their use.

Officers will receipt for polariscopes and apparatus furnished them on form No. 318, which will be sent to the Commissioner of Internal Revenue. Particular care must be taken of these instruments to insure their being kept at all times in good repair and adjustment and ready for use. The lenses shall be cleaned with chamois skin

only, and the metal part kept free from rust and tarnish. Any shock or jarring of the instrument must be avoided, and if it is to be transported from one place to another, the officer having it in charge shall carry it with him as hand baggage if possible. If this is impracticable, however, it must be enclosed in its case, and this carefully packed in a larger box for transportation by express. If an instrument gets out of adjustment beyond the power of the officer to remedy, application must immediately be made for another instrument, by telegraph if necessary, and the crippled instrument shall be sent at once to the Commissioner of Internal Revenue marked "Laboratory," and accompanied by a letter stating the nature of the trouble experienced in using it.

250 Collector's records.

Each collector will keep in his office a record of the operations of sugar factories in his district. The following books are furnished by this office for this purpose:

Book No. 69. Record of producers of sugar from sorghum or sugar cane and of their operations.

Book No. 70. Record of producers of sugar from beets and of their operations.

Book No. 72. Collector's record of sugar weighed and inspected, a record of the quantity of sugar weighed and inspected for each producer and its classification, the date of weighing and inspecting, and by whom weighed and inspected.

Collector's consolidated statement.

When complete annual returns have been received by the collector from all the sugar producers in his district, he will make an abstract or consolidated statement and forward one set of the returns, together with the abstract, to the Commissioner of Internal Revenue, retaining the duplicates on his files. Form 298 will be used for the consolidated statement. In reporting the operations of sugar factories on this form the collector will include all factories using the same process in a single group, separated from the others.

A recapitulation should be made on a separate sheet, showing the following particulars, viz.:

Total number of sugar producers by open-kettle process.
Total number of sugar producers by vacuum-pan process.
Total number of sugar producers licensed and operating.
Total acres of cane or beets cultivated.
Total acres of cane or beets ground.
Total tons of cane or beets ground.
Total quantity of open-kettle sugar produced.
Total quantity of centrifugal sugar produced.
Total quantity of molasses produced.
Total sugar produced testing not less than 90 degrees.
Total sugar produced testing less than 90 degrees and not less than 80 degrees.
Total sugar produced entitled to bounty.

Total sugar produced testing less than 80 degrees (not entitled to bounty).

Total bounty on sugar testing not less than 90 degrees applied for.

Total bounty on sugar testing less than 90 degrees and not less than 80 degrees applied for.

Total sugar on hand at the factory not weighed and inspected.

251 Claims for bounty.

An annual appropriation is not required for the payment of the bounty. The act carries an appropriation with it; that is, it makes what is called a permanent annual appropriation.

Section 3689 of the Revised Statutes under which the bounty is to be paid, includes items which are payable, when the liability accrues, out of any money in the Treasury not otherwise appropriated, and for which a specific appropriation is not required.

The law provides that for the payment of these bounties the Secretary of the Treasury is authorized to draw warrants on the Treasurer of the United States for such sums as shall be necessary, which sums shall be certified to him by the Commissioner of Internal Revenue, by whom the bounties shall be disbursed.

Each individual who claims the bounty will make his application to the Commissioner on the prescribed form through the collector of the district, who, after examining the same and certifying to its correctness, will transmit it to this office, where it will be examined and forwarded to the proper accounting officers of the Treasury to take the usual course of claims against the Government. After the claims have been allowed, drafts upon the Treasury will be issued in payment, which will be mailed or delivered to the persons entitled thereto.

Claims for bounty will be made by the sugar producer on form No. 301, and presented to the collector of internal revenue, accompanied with the certificates of the proper officers, showing the weight and classification of the sugar.

In case the business is under the control of an agent, manager, or superintendent, and the proprietor is not present to make the claim, or, in case of a firm, if no member is present, the claim may be made by such agent, manager, or superintendent in the name of the principal, and sworn to by the person who makes the same, who must be cognizant of the facts in the case. A person not directly identified with the management of the business will not be regarded as competent to make such claim. In case a claim is made by an assignee of an insolvent, or by a receiver, or a trustee, or legal representative of a deceased sugar producer, a certified copy of authority to act in such capacity must accompany the claim in the first instance, and be referred to in subsequent claims as on file in the department.

The collector upon receiving such claims will carefully examine his record and make such other investigation as may be necessary to satisfy himself of their correctness. If the claim is correct, he

will sign a certificate to that effect as printed on the form, and transmit the papers to the Commissioner of Internal Revenue, where the claim will be examined, and, if allowed, it will be forwarded to the proper accounting officers of the Treasury Department.

252 If the collector has reason to question the validity of the claim, the case must be held back until such investigation can be made as will enable him to make a definite recommendation for or against the claim before forwarding it.

The sugar producer will not present claims for bounty oftener than once a week.

Claims for bounty cannot be transferred or assigned. Such assignments are prohibited by section 3477, United States Revised Statutes.

The drafts issued in payment of the claim will be made payable to the order of the sugar producer.

No money shall be paid to any person for bounty who is in arrears to the United States until he has accounted for and paid into the Treasury all sums for which he may be liable.

It is the duty of the collector to inform the Commissioner when any sugar producer in his district is indebted to the United States for taxes or otherwise.

Indorsements on drafts.

The name of the payee, as indorsed, must correspond in spelling with that on the face of the draft; no guarantee of an indorsement, imperfect in itself, can be accepted. If the name of the payee, as written on the face of the draft, is spelled incorrectly, the draft should be returned to the U. S. Treasurer, Washington, D. C., for correction.

Indorsements by mark (x) must be witnessed by two persons who can write, giving their places of residence.

Indorsement by executors, administrators, guardians, or other fiduciaries must be accompanied by certified copies, under seal, of letters testamentary, letters of administration of guardianship, or other evidence of fiduciary character, as the case may be. Such certified copies once filed in the Treasury Department will be accepted for future indorsements until revocation of authority.

If the draft is made payable to an executor or administrator no such evidence is required.

Payees and indorsees must indorse by their own hands; officials, officially with full title; firms, the usual firm signature by a member of the firm, not by a clerk or other person for the firm.

Every indorsement must be by the proper written (not printed) signature of the person whose indorsement is required.

Affidavits.

Affidavits required of sugar producers may be made before a collector, deputy collector, or any officer authorized to administer oaths.

253 If made before an officer without a seal, the collector will satisfy himself that the officer had authority to administer oaths before sending papers to the Commissioner, attaching

his signature to that effect thereto. He should keep a record so far as necessary of such officers within his district as have such authority.

No internal revenue officer will make any charge for administering oaths required to be taken by the regulations.

Penalties.

Any person not entitled to the bounty who shall apply for or receive the same becomes guilty of a misdemeanor and liable to a fine not exceeding five thousand dollars, or imprisonment not exceeding five years, or both.

The same penalty is imposed upon any person who shall knowingly refine or aid in refining sugar imported into the United States or upon which the bounty has been paid or applied for at the place described in the license.

Forms and returns.

Collectors of internal revenue will be supplied with the proper blank forms that are furnished by the Government, and persons intending to manufacture sugar and apply for the bounty will be able to obtain the same upon application to those officers.

Regulations and instructions to be furnished sugar producers.

Collectors will furnish a copy of these regulations to each producer of sugar from beets, sorghum, or sugar cane in their respective districts.

Instructions relative to the books which will be required to be kept by sugar producers, the manner of making returns, the weighing and inspection of the sugar, and information relative to the payment of bounty and to the law and regulations will be furnished by collectors of internal revenue to persons interested; but all new questions or points upon which a clear understanding does not exist must be referred to the Commissioner of Internal Revenue for his ruling thereon.

Additional regulations.

The law provides that "the Commissioner of Internal Revenue, with the approval of the Secretary of the Treasury, shall from time to time make all needful rules and regulations for the manufacture of sugar from sorghum, beets or sugar cane grown within the United States, or from maple sap produced within the United States."

254 Regulations in regard to the bounty of maple sugar.

Regulations concerning the bounty on maple sugar will be issued in a separate pamphlet, to be known as Series 7, No. 17, Revised Supplement No. 1.

Regulations in regard to the use of distilled spirits free of tax for making sugar from sorghum.

Regulations relative to use of distilled spirits free of tax for making sugar from sorghum under the provisions of the act of March 3, 1891, making appropriation for the Department of Agriculture for the fiscal year ending June 30, 1892, have been prepared and are known as Series 7, No. 7, Revised Supplement No. 1.

G. W. WILSON.
Acting Commissioner.

Approved:
O. L. SPAULDING,
Acting Secretary of the Treasury.

APPENDIX.

Blank Forms and Books Relating to Sugar Bounty.

Blank forms.

Form No.

278. Sugar producer's bond.
287. Notice and application for license by producers of sugar from beets, sorghum, or sugar cane.
288. Notice and application for license and bond of producers of sugar from maple sap.
293. Form of book to be kept by producers of sugar from beets.
294. Monthly return of producers of sugar from beets.
295. Form of book to be kept by producers of sugar from sorghum or sugar cane.
296. Monthly return of producers of sugar from sorghum or sugar cane.
297. Annual return of producers of sugar from beets, sorghum, or sugar cane.
298. Collector's consolidated statement of sugar factories (annual).
299. Consignee's notice of arrival of sugar, and application for weighing and inspection.
300. Sugar producer's notice and application for weighing sugar at factory.
301. Claim for bounty on sugar of domestic production.

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313. Inspector's monthly report of sugar inspected and classified.
314. Label for tin box for sugar samples.
315. Label for chest containing sugar samples.
316. Weigher's return of sugar weighed.
317. Inspector's return of sugar inspected and classified (on same form as weigher's return).
318. Receipt for polariscopes, etc.
319. Return of sugar sampled (bound in books of 100 each).
321. Record to be kept by producers of maple sugar. (Claim for bounty on same form.)

323. Application for weighing and inspection of maple sugar.
326. Weigher's return of maple sugar weighed.
327. Inspector's return of maple sugar inspected and classified (on same form as above).
329. Label for tin box for maple sugar samples.

Blank books.

Book No.

69. Collector's record of producers of sugar from sorghum or sugar cane.
70. Collector's record of producers of sugar from beets.
72. Collector's record of sugar weighed and inspected.
74. Weigher's daily record of sugar weighed and sampled (4 sizes, 4, 8, 16, and 20 leaves).
75. Inspector's record of sugar inspected and classified.
76. Reports of polariscopic tests of sugar.
77. Record of sugar samples and polariscopic tests.
78. Collector's record of maple sugar producers.
79. Collector's record of weigher's and inspector's returns of maple sugar.
82. Weigher's record of maple sugar weighed.

Forms relating to account of spirits used for manufacture of sugar from sorghum.

Form No.

304. Sorghum sugar manufacturer's application for distilled spirits to be used in the manufacture of sugar from sorghum.
305. Permit for the withdrawal from distillery warehouses free of tax of distilled spirits to be used in the manufacture of sugar from sorghum.
306. Collector's order for inspection and delivery of distilled spirits to be used in the manufacture of sugar from sorghum.
307. Manufacturer's monthly statement of distilled spirits used in the manufacture of sugar from sorghum.
308. Daily return of deputy collector and gauger of distilled spirits used in the manufacture of sugar from sorghum.

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309. Monthly return of deputy collector and gauger of distilled spirits used in the manufacture of sugar from sorghum.
310. Monthly statement of collectors, distilled spirits bonded for use in the manufacture of sugar from sorghum.

EXHIBIT 3, 34769 F, DEC. 16, 1898.

Serial No.	Polarization by—			Maximum difference.
	Sherer Bros.	G. Grund.	A. Weichert.	
9380	87.40	86.80	86.40	1.00
9381	84.20	84.40	84.50	.30
9382	87.30	88.10	87.20	.80
9383	87.40	87.70	87.40	.30
9384	88.10	88.00	87.50	.60
9385	78.40	78.50	78.60	.20
9386	86.60	87.20	86.40	.80
9387	87.10	87.50	86.70	.80
9388	87.40	87.50	86.90	.60
9389	89.80	90.60	89.80	.80
9391	96.00	96.10	95.70	.40
9392	95.00	95.90	94.70	.50
9458	95.80	96.00	96.50	.50
9459	95.60	95.90	95.70	.30
9460	95.10	95.30	94.80	.50
9461	95.80	96.30	96.10	.50
9462	94.60	95.10	94.90	.50
9463	95.80	95.90	95.60	.30
9464	96.10	96.20	96.10	.10
9465	95.70	95.80	95.30	.20
9466	95.70	95.80	95.60	.20
9467	97.00	96.90	96.40	.60
9469	97.10	97.50	97.10	.40
9470	97.10	97.70	97.10	.60
9473	97.60	97.70	97.40	.30
Totals.....	2303.60	2309.70	2299.40	.42
Average.....	92.15	92.39	91.98	

Table showing differences in polarizations of samples taken from some sample by U. S. appraisers, when polarized by chemists as noted.

257 EXHIBIT 4, 34,769 F, DEC. 17, 1898.

Beet-root sugar analysis. Resolutions of the Austro-Hungarian chemists engaged in the sugar industry at the meeting at Buda Pesth, June 22, 1895. (Zeits angew. Chem. 1897, 123-126. Also Jour. Soc. Chem. Ind., 1897, 472.)

Polarization.—For polarizing substances contained in sugar only the half-shadow instrument is to be used. It is desirable to use the 400 m. m. apparatus with contracted scale. During the observation, the polariscope must be in a fixed position, so far from the source of light that the polarizing nicol does not become heated. As source of light, a lamp with an intense flame is recommended; a triplex gas jet with metal chimney, lens and reflector; gas with the Auer burner, electric lamps, duplex petroleum lamps, &c. The chemist must satisfy himself as to the accuracy of the instrument by correct quartz plates, and of the invariability of the light before and after the observation; also of the accuracy of the weights, the polarization flasks, the observation tubes and the cover glasses. Scratched cover glasses must not be used. Results are to be expressed to the half of one-tenth per cent.

Analysis of raw sugar.—On opening the sample, the upper layer is to be removed with a spatula or spoon and discarded. The remainder is to be completely emptied into a porcelain dish and mixed. Any lumps may be easily crushed with a spoon. The sample is then replaced and the weighings made forthwith. For the polarization of first products, at least the normal weight should be weighed out, dissolved in distilled water without the aid of heat, and, after clarifying, made up to 100 c. c. at the ordinary temperature (not too far from 17.5 deg. C.) Of after-products it is advisable to take a multiple of the normal weight and make up a corresponding volume. The flask must be standardized with water at 17.5 deg. C. For clarifying and decolorizing, basic acetate of lead may be used (3 parts of lead acetate, 1 of litharge, 10 of water), concentrated solution of alum and Scheibler's colloidal alumina. Char and decolorizing powder are absolutely excluded. For sugars polarizing over 99, alum or colloidal alumina alone will suffice; for first products, 1 c. c. of acetate of lead and 1 c. c. of alum solution, and for after products, 2 to 3 c. c. of acetate of lead, 1 to 2 c. c. of alum solution for each 100 c. c. After making up the mark and wiping out the neck of the flask with filter paper, the clarified sugar solution is well shaken, and the entire contents poured on to a dry quick-filtering filter. The first portion running through is poured away, and the rest, which should be perfectly clear, is used for polarizing.

258 For determining *water*, only water baths are to be used, with or without vacuum pump. Air baths are absolutely excluded. 10 to 15 grms. are dried for two hours. Sugars containing more than 3 per cent. of water are dried for a double period of time. After cooling in a desiccator, loss is taken as water.

Exhibit 5.

34769 F, Dec. 17, 1898.

Experiments of Sachs may be cited, published in Zeits. Ver. Rubenzuckerind, 1896 (46,264), as follows:

(Abs. Soc. Chem. Ind., 1896—831.)

The author found that in the polarization of raw sugar at temperatures from 14 deg. to 26 deg. C. there were differences of almost exactly 0.1 deg. per 2 deg. C., as Wartze had already observed. But it is not sufficient to note the temperature of the solution polarized and to correct by the above factor unless regard is had to the temperature at which the 100-c. C. flask is made up to the mark. Thus, a normal solution made up and polarized at 25 deg. C. showed a difference, not of 0.5 deg., but of 0.2 deg. merely. In weaker solutions the influence is obviously still smaller. Finally, Sachs states that the quartz control plates are only very slightly affected by temperature. Pellet (La. Sue. Indig. 1896, 31, 494) is of opinion that the influence of temperature should not be neglected, and that a jacketed tube should be used to keep the temperature constant. He remarks that in order to obtain exact and comparable results, the gas, paraffin, or electric light used should be maintained at the same intensity of illumination. At present this is by no means the case, even with monochromatic flames, so that differences may be obtained of 0.2 to 0.5 in the readings. It appears, therefore, of advantage to have an arrangement to determine readily the intensity of the light used, and he describes one similar to that used in photography to study the sensitiveness of paper. Black numbers are written on a glass plate, and these are covered with layers of thicker or thinner paper. It is so arranged that before a polarization the numbers must always be visible which are covered with, say, four layers of paper.

259 Protest No. 3118, Bertram Bros. ex. "Cameo."

	Official.	Settlement.
B P 196 bgs	87.30	86.35
F R		
B S 187 "	93.70	92.95
P T		
B H 17 hhds	81.10	81.65
R F 50 bbls	82.5865	80.85
L L 450 bgs	87.45	87.75

In the above appraisements three of the settlements are higher than the official tests and two are lower.

Protest 31501, B. H. Howell, Son & Co. ex. "Santiago."

	Official.	Settlement.
Homiguero 4000 bgs	95.83	95.81
3200 "	95.83	95.81

In this case both settlement and official tests are practically the same.

Protest 326623, Amer. Sugar Refining Co. ex. "Oleodene."

Various marks.	Official.	Settlement.
14000 bgs	95.3127	95.448

In this case the settlement is higher than the official.

Amer. Sugar Refining Co. ex. "Bergen."

Various marks.	Official.	Settlement.
6500 bgs	95.61628	95.615

Protest 31501 F, B. H. Howell, Son & Co., ex. Santiago.

	Official.	Settlement.
Homiguero 4000 bgs	95.83	95.81
3200 "	95.83	95.81

In this case both settlement and official tests are practically the same.

260 Protest 3266 F, Amer. Sugar Refining Co. ex. "Oleodene."

Various marks.	Official.	Settlement.
14000 bgs	95.3127	95.448

Amer. Sugar Refining Co. ex. "Bergen."

Various marks.	Official.	Settlement.
6500 bgs	95.61628	95.615

Compilation of Tests made by William C. Jacobs.

(See his Testimony, p. 251.)

Importer	Vessel	No. of Packages	Settlement Test	Official Test	Difference in favor of Revenue	Difference in favor of Merchant
Amer. Sugar Ref. Co	Shenandoah	1890 Bags	95.22	95.23	.01	
" " " "	Delta	844 "	96.	95.82		.18
" " " "	"	780 "	95.30	95.37	.07	
" " " "	"	1800 "	95.80	96.05	.25	
" " " "	"	1500 "	96.65	96.32		.33
" " " "	John Swan	13803 "	84.33	84.26		.07
" " " "	Santiago	1667 "	95.50	95.55	.05	
" " " "	"	1333 "	84.10	84.06		.04
" " " "	Arcadia	202 Hhds	88.48	89.37	.89	
" " " "	"	100 Bags	96.30	96.90	.61	
" " " "	"	300 "	95.05	95.05		
" " " "	"	500 "	96.45	97.07	.62	
" " " "	"	1000 "	96.10	96.97	.87	
" " " "	"	249 "	96.35	97.12	.77	
" " " "	Curacoa	2256 "	93.57	93.07		.51
" " " "	"	1068 "	86.20	85.80		.31
" " " "	Vittoria	4217 "	94.90	94.48		.42
" " " "	"	100 "	95.	95.28	.23	
" " " "	"	1683 "	96.15	96.27	.12	
" " " "	Saratoga	1000 "	94.55	94.37		.18
" " " "	Strathfillin	1127 "	89.20	89.32	.12	
" " " "	"	1120 "	89.60	89.67	.07	
" " " "	"	500 "	90.	89.82		.18

Importer	Vessel	No. of Packages.	Settlement Test	Official Test	Difference in favor of Revenue	Difference in favor of Merchant
Amer. Sugar Ref. Co.	Strathfillin	960 Bags	90.40	90.35		.05
" " " "	"	500 "	91.30	91.75	.45	
" " " "	"	700 "	91.30	91.82	.52	
" " " "	"	500 "	90.30	90.17		.13
" " " "	"	500 "	90.	90.20	.21	
" " " "	"	500 "	90.	90.20	.21	
" " " "	"	500 "	90.	89.97		.03
" " " "	"	500 "	91.	91.42	.42	
" " " "	"	549 "	92.70	93.12	.42	
" " " "	"	500 "	93.50	93.65	.15	
" " " "	"	500 "	90.	90.07	.07	
" " " "	"	549 "	89.70	89.90	.21	
" " " "	"	448 "	90.80	91.35	.55	
" " " "	"	500 "	91.	91.25	.25	
" " " "	"	500 "	90.90	91.17	.27	
" " " "	"	736 "	90.51	91.02	.51	
" " " "	"	500 "	89.92	89.87		.03
" " " "	"	500 "	90.30	92.40	2.10	
" " " "	"	400 "	91.20	91.07		.13
" " " "	"	500 "	90.	90.17	.17	
" " " "	"	706 "	91.50	91.92	.42	
" " " "	"	739 "	90.10	90.50	.40	
" " " "	"	500 "	90.70	91.42	.72	
" " " "	"	500 "	90.80	90.60		.21

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Importer	Vessel	No. of Packages	Settlement Test	Official Test	Difference in favor of Revenue	Difference in favor of Merchant
Amer. Sugar Ref. Co	Strathfillin	500 Bags	90.90	91.	.10	
" " " "	"	404 "	90 80	90.67		.13
" " " "	Irma	5038 "	82.41	81.88		.53
" " " "	Earlswood	7000 "	88.30	87.98		.32
" " " "	Tyler	200 Hhds.	90 55	90.10		.45
" " " "	"	156 Bbls.	92.25	92.47	.22	
" " " "	Went-worth	2023 Bags.	94.70	94 26		.44
" " " "	"	1523 "	96.37	96.30		.07
" " " "	Virginia	67 Hhds.	87.25	89.35	2.10	
" " " "	"	50 "	91.45	90.93		.52
" " " "	"	18 "	88.35	89.45	1.10	
" " " "	"	761 "	87.40	87.51	.11	
" " " "	"	30 Cases	89.25	88.90		.35
" " " "	"	59 Bbls.	87.50	86.67		.83
" " " "	"	30 "	82.20	86.67	4 47	
" " " "	"	44 Hhds.	88.20	89.90	1.70	
" " " "	"	40 "	86.75	86.82	.07	
" " " "	"	32 "	88.20	90.	1.80	
" " " "	"	18 "	88.35	89.45	1.10	
" " " "	"	100 Bbls.	83.80	83.52		.28
" " " "	"	29 Hhds.	89.75	89.70		.05
" " " "	"	52 "	87.50	87.57	.07	
" " " "	"	21 "	89.25	89.60	.35	

Importer	Vessel	No. of Packages	Settlement Test.	Official Test	Difference in favor of Revenue	Difference in favor of Merchant
Amer. Sugar Ref. Co.	Virginia	36 Hhds	81.95	84.22	2.27	
" " " "	"	53 "	86.40	85.51		.89
" " " "	Crosby	300 "	88.15	88.35	.21	
" " " "	"	60 "	87.75	87.62		.13
" " " "	Olivedene	4760 Bags	96.23	96.09	.14	
" " " "	"	2040 "	96.75	96.50		.25
" " " "	Laurca	14400 "	85.36	85.15		.21
" " " "	Condor	2100 "	94.12	93.77		.35
" " " "	"	432 "	95 30	95.10		.21
" " " "	"	1800 "	95.45	95.42		.03
" " " "	Ludwig	1000 "	91.80	91.65		.15
" " " "	Garonne	7800 "	96.26	96.19		.07
" " " "	Ormiston	500 "	89.60	89.60		
" " " "	"	538 "	89.50	89.82	.32	
E. Atkins	Sarah & Ellen	3550 "	91.20	91.68	.48	
Armstrong & Co.	Irrawaddy	230 "	96.60	96.50		.10
" " " "	Ulla	1139 Hhds.	91.05	91.18	.13	
" " " "	"	5538 Bags	87.80	88.03	.23	
" " " "	"	4054 "	96.60	97.18	.58	
" " " "	Tjoma	7777 "	87.95	87.46		.49
" " " "	"	1110 Hhds.	90.94	90.91		.03

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Importer	Vessel	No. of Packages	Settlement Test	Official Test	Difference in favor of Revenue	Difference in favor of Merchant
Czarnikow, McD &Co.	New York Prince	1250 Bags	96.60	96.62	.02	
" " "	F. Hendrik	1083 "	94 55	95.07	.52	
" " "	Navarino	2715 "	96.40	96.75	.25	
" " "	"	1413 "	89.65	90.62	.97	
" " "	"	162 "	89.65	90.70	1.05	
" " "	Caribbee	400 "	94.50	95.	.50	
" " "	Holstein	250 "	90.10	90.77	.67	
" " "	La Pieta	200 "	90.	90.27	.27	
" " "	Caribbee	400 "	94.50	95.	.51	
" " "	"	20 Hhds.	90.10	90.10		
" " "	"	20 "	91.25	91.10		.15
" " "	Olivedene Prince	4331 Bags	96.30	96.55	.21	
" " "	Wm. Third	1200 "	97.05	97.29	.24	
" " "	Athos	201 "	92.05	93.52	1.47	
" " "	Granada	910 "	96 45	96.72	.27	
" " "	Cherokee	1700 "	96.63	96.92	.29	
" " "	Caribbee	100 "	88.20	88.25	.05	
" " "	"	21 Bbls	86.35	85.22	1.12	
" " "	"	12 Hhds.	90.60	90.07		.53

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Importer	Vessel	No. of Packages	Settlement Test	Office Test	Difference in favor of Revenue	Difference in favor of Merchant
	PrinceFred					
Carnikow, McD & Co.	Hendrik	941 Bags	89.35	90.02	.67	
" " "	Fontabelle	30 Hhds.	91.15	91.12		.03
" " "	"	34 "	89.75	90.32	.57	
" " "	"	134 Bags	90.60	90.10		.51
" " "	"	20 Hhds.	90.30	90.67	.37	
James Lee & Co.,	Holstein	300 Bags	89.80	90.60	.81	
" " "	"	330 "	89.40	90.17	.77	
" " "	"	405 "	90.30	90.12		.18
" " "	"	414 "	89.50	90.32	.82	
" " "	"	40 "	89.40	89.55	.15	
" " "	"	55 "	90.10	91.15	1.05	
" " "	"	50 "	89.70	89.50		.21
" " "	"	65 "	91.	91.30	.30	
" " "	Ardandhu	213 "	89.85	90.30	.45	
" " "	"	130 "	89.50	89.27		.23
" " "	"	87 "	91.20	91.17		.03
" " "	"	228 "	89.10	90.22	1.12	

267.

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Importer	Vessel	No. of Packages	Settlement Test	Official Test	Difference in favor of Revenue	Difference in favor of Merchant
James Lee & Co.,	Ardandhu	179 Bags	88.20	88.62	.42	
" " "	"	198 "	91.75	91.82	.07	
" " "	Athos	220 "	90.15	90.92	.77	
	Gypsum					
" " "	Princess	596 "	88.	88.42	.42	
	Gypsum					
Leaycraft & Co ,	King	400 "	89.25	91.30	2.05	
" "	Caribbee	250 "	89.50	89.20		.30
" "	"	23 Hhds	87.45	87.15		.30
" "	"	20 "	85.90	85.40		.50
Lascelles & Co.,	L. G.					
" "	Cresby	157 "	89.60	89.52		.08
" "	"	27 "	87.90	88.32	.42	
" "	"	45 Bags	96.70	97 15	.45	
	"	155 "	95.80	96.97	1.17	
Leaycraft & Co.,	Madiana	250 "	89.80	90.27	.47	
" "	"	500 "	90.60	90.72	.12	
" "	La Pieta	425 "	83.90	83.40		.50
" "	" "	170 "	86.05	88.32	2.27	
" "	Athos	220 "	89.50	91.47	1.97	
" "	Caribbee	24 Bbls.	87.	86.70		.30

Importer	Vessel	No of Packages	Settlement Test	Official Test	Difference in favor of Revenue	Difference in favor of Merchant
Leaycraft & Co.	Caribbee	53 Tbls.	85.40	85.02		.38
" "	"	34 "	86.55	86.47		.08
" "	"	24 "	80.85	80.45		.40
" "	"	14 "	86.25	85.62		.63
" "	"	150 "	84.15	85.45	1.30	
" "	Fontabelle	32 "	81.25	83.17	1.92	
" "	"	30 "	86.60	86.82	.22	
" "	"	350 Bags.	86.45	85.42		1.03
" "	"	400 "	89.30	90.95	1.65	
" "	"	300 "	89.25	89.82	.57	
" "	"	500 "	89.90	90.67	.77	
" "	"	20 Hhds.	89 20	89.05		.15
" "	"	10 "	87.50	87.62	.12	
" "	"	20 "	83.85	82.10		1.75
" "	"	10 "	81.70	81.07		.63
" "	"	10 "	86.60	85.32		1.28
" "	"	20 "	79.80	76.95		2.85
" "	"	20 "	83.20	81.92		1.28

269.

400

Importer	Vessel	No. of Packages	Settlement Test	Official Test	Difference in favor of Revenue	Difference in favor of Merchant
Leaycraft & Co.	Fontabelle	30 Hds	77.95	77.75		.20
" " "	"	100 Bbls	86.85	88.80	1.95	
" " "	"	50 Bags	83.	82 05		.95
" " "	"	250 Bbls	88.20	87.83		.37
" " "	"	250 Bbls	88.70	88.66		.04
" " "	"	380 Bags	88.70	88.62		.08
Benjamin Perkins	Caribbee	20 Hhds	89.75	88.87		.88
" " "	"	24 Bbls	88.10	87.67		.43
" " "	"	200 Bags	88.10	87.82		.28
" " "	"	150 Bags	88.15	88.23	.08	
" " "	"	150 Bags	88.	87.26		.74
" " "	"	15 Bbls	88.75	86.90		.85
" " "	"	15 "	85.55	84.50		1.05
" " "	"	35 "	80.20	79.92		.28
" " "	"	48 "	84.15	84.32	.17	
" " "	"	100 "	87 20	87.86	.66	
" " "	"	16 "	85.20	85.15		.05
" " "	"	20 "	87.95	88.62	.67	

Importer	Vessel	No. of Packages	Settlement Test	Official Test	Difference in favor of Revenue	Difference in favor of Merchant
Benjamin Perkins	Caribbee	16 Bbls	82.60	81.37		1.23
" "	"	11 "	82.75	82.35		.40
" "	"	100 Bags	87.	86.90		.10
" "	"	100 "	85.90	85.92	.02	
" "	Madiana	60 Hhds	89.25	89.50	.25	
" "	"	22 Bbls	85.25	82.92		2.33
" "	Athos	198 Bags	91.90	92.22	.32	
" "	"	148 "	91.60	93.10	1.50	
Gillespie Bros.	Holstein	180 "	91.65	92.22	.57	
	Albert					
" "	Dumois	155 "	93.15	93.50	.35	
" "	Pretoria	81 "	87.25	87.77	.52	
" "	"	81 "	87.80	88.12	.32	
" "	Caribbee	90 "	87.80	88.02	.22	
" "	"	90 "	88.05	88.27	.22	
" "	"	90 "	88.10	88.17	.07	
" "	"	180 "	87.65	88.13	.48	
" "	"	90 "	87.45	87.42		.03

271.

402

Importer	Vessel	No. of Packages	Settlement Test	Official Test	Difference in favor of Revenue	Difference in favor of Merch
Onterbridge & Co.,	Caribbee	123 Bbls.	85.80	86.15	.35	
" "	"	177 "	89.	89.15	.15	
" "	"	200 Bags	88.60	88.76	.16	
" "	"	300 "	87.65	88.42	.77	
B. H. Howell,	Fontabelle	306 "	97.60	98.05	.45	
" "	"	971 "	97.10	97.33	.23	
" "	"	3753 "	96.55	96.96	41	
" "	"	42 "	97.45	97.40		.05
" "	"	706 "	97.10	97.		.10
" "	"	464 "	96.80	96.69		.11
" "	"	611 "	96.70	97.13	.43	
" "	"	142 "	89.10	89.62	.52	
" "	"	175 "	90.85	91.12	.27	
" "	"	173 "	88.85	89.25	.40	
" "	"	128 "	86.40	86.60	.20	
" "	"	82 "	88.15	88.27	.12	
" "	"	162 "	91.05	91.47	.42	
" "	"	150 "	91.65	91.52		.13
" "	"	167 "	90.05	90.92	.87	

Importer	Vessel	No. of Packages	Settlement Test	Official Test	Difference in favor of Revenue	Difference in favor of Merchant
B. H. Howell,	Fontabelle	328 Bags	90.40	90.59	.10	
" "	"	354 "	89.40	90.70	1.30	
" "	Pretoria	800 "	94.	94.30	.30	
" "	"	1200 "	88.	88.12	.12	
" "	Jas. Brown	2768 "	93.30	92.80		.50
" "	" "	745 "	88.65	88.05		.60
" "	Cheslie	1690 "	95.60	95.89	.29	
" "	"	2386 "	87.95	88.19	.24	
Meeke & Co.,	New York	1375 "	97.20	97.52	.32	
Macy & Dunham	Holstein	280 "	91.12	91.22	.10	
" "	Gypsum Kin	1000 "	91.40	92.30	90	
" "	"	500 "	91.65	92.62	.97	
Middleton & Co.,	Fontabella	287 Bbls	84.90	84.35		.45
" "	"	105 "	82.65	82.97	.32	
" "	"	75 "	86.85	87.27	.42	
" "	"	75 Hhds	82.30	81.55		.75
" "	"	75 "	83.50	83.20		.30
" "	"	35 "	86.55	85.05		1.50

273.

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Importer	Vessel	No. of Packages	Settlement Test	Official Test	Difference in favor of Revenue	Difference in favor of Merchant
Middleton & Co.,	Fontabelle	39 Hhds	84.75	86.05	1.30	
A. D. Straus,	Granada	134 Bags	96.80	97 37	.57	
" "	Irrawaddy	360 "	97.50	97.92	.42	
Nevers & Callahan,	Honiton	6536 "	96.81	97.37	.56	
" "	"	2716 "	96.	96.60	.60	
" "	"	1000 "	94.50	95.30	.80	
" "	"	331 "	94.50	95.32	.82	
" "	"	1520 "	95.20	96.27	1.07	
Eimenhorst & Co.,	New York	700 "	97.05	97.25	.20	

Importer.	Vessel.	No. of Packages.	Settlement Test.	Official Test.	Difference in favor of Revenue.	Difference in favor of Merchant.
Leaycraft & Co.	Fontabelle	10 Bbls.	87.60	89.75	2.15	
" " "	"	20 Hhds.	88.80	88.40		.40
" " "	"	27 "	86.25	86.95	.70	
" " "	"	30 "	90.00	89.67		.33
" " "	"	100 Bbls.	88.40	88 80	.40	
" " "	"	200 "	86.10	86.52	.42	
" " "	"	100 Bags	87.65	87.92	.27	
" " "	"	180 "	88.85	88.77		.08
Amsinck & Co.	Ely	700 "	95.25	95.76	.51	
" " "	"	111 "	84.50	85.00	.50	
" " "	"	1890 "	92.95	92.87		.08
" " "	"	298 "	85.20	85.51	.31	
Park, Son & Co.	Carribee	49 Hhds.	89.10	89.32	.22	
" " " "	"	35 "	82 15	82.55	.40	
" " " "	"	28 "	87.85	88.00	.15	
" " " "	"	22 Bbls.	85.85	84.95		.90
Lascelles & Co.	Arcadia	1267 Hhds.	89.36	89.53	.17	
" " "	"	747 "	89.08	89.35	.27	
Morewood & Co.	Carribee	500 Bags	96.70	96 65		.05
B. H. Howell,	C. Rice	9116 "	96.35	96.76	.41	
Amer. Sugar Ref. Co.	Irrawaddy	3000 "	97.17	97.15		.02
" " " "	"	1600 "	96.50	96 87	.37	
" " " "	"	1600 "	97.15	97.98	.83	

Importer	Vessel	No of Packages	Settlement Test	Official test	Difference in favor of Revenue	Difference in favor of Merchant
Amer. Sugar Ref. Co.	Irrawaddy	2816 Bags	96.35	96.80	.45	
Czarnikow, McD. & Co	Sayre	9900 "	96.21	96.59	.38	
Amer. Sugar Ref. Co	Pretoria	5000 "	87.44	88.40	.96	
" " " "	Senator Versmann	2134 Bkts	97 07	97.22	.15	
Czarnikow, McD. & Co.	Irrawaddy	1460 Bags	96.65	97.00	.35	
Morewood & Co.	Madiana	630 "	96.85	97.72	.87	
	Prince Fred	- -				
Czarnikow, McD. & Co	Hendrick Lillian	941 "	90.02	90.02		.06
Bartram Bros.	Woodruff	3400 "	96.85	96.79		
" "	Fontabelle	300 "	88.60	88.42		.18
" "	"	200 "	89.00	89.37	.37	
" "	"	150 "	87.95	87.85		.10
" "	"	154 "	87.55	88.10	.55	
" "	"	20 Hhds	90.10	89.92		.18
" "	"	50 "	91.85	91.50		.35
" "	"	50 "	90.40	90.17		.23
Bowerman & Bros.	Abydos	2047 Bags	94.65	94.54		.11
" " "	"	1300 "	95.95	95.95		
" " "	"	1047 "	95.20	95.95	.75	
" " "	"	349 "	96.40	96.85	.45	
" " "	"	91 "	86.20	85.60		.60
" " "	"	76 "	88.20	88.67	.47	
" " "	"	200 "	90.30	90.57	.27	
" "	"	30 Hhds	86.52	86.55	.03	

275.

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Importer.	Vessel	No. of Packages	Settlement Test	Official Test	Difference in favor of Revenue	Difference in favor of Merch't
Park & Son.	La Pieta	97 Bags	87.60	87.		.60
" " "	" "	41 "	88.80	87.70		.10
" " "	Florence	2480 "	87 05	87.04		.01
" " "	"	5323 "	87.40	87.36		.04
" " "	"	735 Bbls	87.35	88.01	.66	
Benjamin Perkins.	Gypsum King	500 Bags	86 40	85.57		.83
J. Farr.	Sabralense	200 Hhds	91.16	91.64	.48	
B. H. Howell	Vimeria	24536 Bags	95.20	95.66	.46	
Park & Son.	Pretora	251 "	95.05	94.70		.35
" " "	"	45 Hhds	87.85	87.95	.10	
" " "	"	14 Bbls	87.50	86.82		.68
" " "	"	458 Bags	89.60	90.70	1.10	
" " "	Holstein	26 Bbls.	93.35	93.15		.20
" " "	"	290 Bags	89 05	90.45	1.40	
" " "	"	30 Bbls.	87.	86.90		.10
" " "	"	400 Bags	89.60	89.40		.20
" " "	"	262 "	91.80	91.50		.30
" " "	"	312 "	89.50	90.12	.62	
" " "	Carribee	10 Bbls.	87.20	86.07		1.13
" " "	"	25 Hhds.	88.35	88 30		.05
" " "	"	40 "	87.40	87.85	.45	
" " "	"	30 "	87.95	87 85		.10
" " "	"	40 Bbls.	83.80	83.70		.10
" " "	"	89 Hhds.	88.91	88.93	.02	

Importer	Vessel	No. of Packages	Settlement Test	Official Test	Difference in favor of Revenue	Difference in favor of Merchant
Park & Son	Carribee	49 Hhds	89.10	89.32	.22	
" " "	"	28 "	87.85	88.	.15	
" " "	"	15 Bbls	85.85	86.82	.97	
L. Turnure & Co.	Ely	3181 Bags	95.25	95.60	.35	
" " " "	"	1200 "	86.36	86.70	.34	
" " " "	Sarah D. Fell	5380 "	88.89	89.35	.46	
" " " "	Strathdene	80 "	96.25	96.95	.70	
" " " "	"	170 "	90.70	90.97	.27	
J. W. Wilson & Co.	Holstein	235 "	90.45	90.42		.03
Nevers & Callaghan	Honiton	6536 "	96.81	97.37	.56	
" " "	"	2716 "	96.	96.60	.60	
" " "	"	1000 "	94.50	95.30	.80	
" " "	"	331 "	94.50	95.32	.82	
" " "	"	1520 "	95.20	96.27	1.07	
John Farr	La Pieta	2 Hhds	85.75	85.05		.70
" "	" "	5 "	89.10	88.97		.13
" "	" "	170 Bags	88.95	90.07	1.12	
" "	" "	120 "	87.75	87.85	.10	
" "	" "	269 "	89.20	90.05	.85	
" "	" "	150 "	87.20	86.90		.30
" "	Carribee	360 "	88.10	87.65		.45
" "	"	90 "	86.85	87.72	.87	
" "	"	40 Hhds	89.75	89.85	.10	
" "	"	5 Bbls	90.60	90.42		.18

277.

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Importer	Vessel	No. of Packages	Settlement Test	Official Test	Difference in favor of Revenue	Difference in favor of Merchant
John Farr	Carribee	12 Bbls	90.20	90.25	.05	
" "	"	16 "	83.90	82.02		1.88
" "	"	34 "	86.65	87.40	.75	
" "	Fontabelle	250 Bags	89.65	90.20	.55	
" "	"	225 "	88.10	88.60	.50	
" "	"	600 "	89.25	89.95	.70	
" "	"	34 Hhds	89.92	89.80		.12
" "	Earnwood	500 Bags	97.	97.25	.25	
" "	"	200 "	96.80	97.27	.47	
" "	"	306 "	96.95	97.	.05	
" "	"	136 "	96.90	97.30	.40	
" "	"	240 "	97.15	97.37	.22	
" "	Madiana	50 Hhds	90.15	89.60		.55
" "	"	500 Bags	89.95	90.07	.12	
" "	"	315 "	87.25	87.82	.57	
" "	"	20 Bbls	90.15	90.25	.10	
J. W. Wilson	Gypsum King	600 Bags	90.10	89.72		.38
" " "	" "	600 "	86.50	87.	.50	
" " "	" "	400 "	89.80	90.35	.55	
" " "	" "	318 "	90 10	90.37	.27	
" " "	" "	800 "	90.20	90 35	.15	
" " "	" "	500 "	90.50	90 27		.23
" " "	Athas	470 "	89.45	89 55	.10	

Importer	Vessel	No. of Packages	Settlement Test	Official Test	Difference in favor of Revenue	Difference in favor of Merchant
ılden & Bernheim.	La Pieta	801 Bags	90.85	91.70	.85	
" " "	" "	420 "	89.05	88.90		.15
" " "	" "	330 "	89.70	91.27	1.57	
" " "	" "	401 "	89.95	88.87		.98
" " "	" "	175 "	89.05	89.17	.12	
" " "	" "	256 "	88.25	88.10		15
" " "	" "	60 "	86 90	88.95	2.05	
" " "	" "	42 "	89.90	90.70	.80	
" " "	" "	347 "	88.35	87.77		.58
" " "	" "	250 "	87.60	87.47		.13
" " "	" "	110 "	87.15	87.82	.67	
Czarnikow, McD. & Co.	Fontabelle	450 "	89.10	89.25	.15	
Amer. Sugar Ref. Co.	Virginia	140 Hhds.	85.40	87.05	1.65	
" " " "	"	32 Trs.	89.25	88.90		.35
" " " "	"	59 Bbls.	87.50	86.67		.83
" " " "	"	20 "	88.90	89.12	.22	
" " " "	"	18 "	88.35	89.45	1.10	
" " " "	"	32 "	88.20	90.	1.80	
" " " "	"	40 "	86.35	86.82	.47	
" " " "	"	57 "	87.25	89.35	2 10	
" " " "	Strathfillin	500 Bags	90.50	90.57	.07	
" " " "	"	500 "	90.80	91.07	.27	
" " " "	"	217 "	91.	91.		
" " " "	"	386 "	92.20	92.35	.15	

279.

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Importer	Vessel	No. of Packages	Settlement Test	Official Test	Difference in favor of Revenue	Difference in favor of Merchant
Amer. Sugar Ref. Co.	Strathfillin	500 Bags	90.80	90.67		.13
" " " "	"	520 "	91.30	91.62	.32	
" " " "	"	500 "	90.20	90.60	.40	
" " " "	"	1324 "	90.30	90.52	.22	
" " " "	"	500 "	92.70	92.77	.07	

Importer	Vessel	No. of Packages	Settlement Test	Official Test	Difference in favor of Revenue	Difference in favor of Merchant
Osterbridge & Co.	Madiana	4 Bbls.	87.75	85.70		2.05
" " "	"	46 "	87.25	87.27	.02	
" " "	"	2 Hhds	87.75	91.77	4.02	
Nevers & Callaghan	Newton	2160 Bags	95.30	95.65	.35	
" " "	"	1901 "	95.65	95.77	.12	
" " "	"	50 "	90.10	91.27	.17	
Middletown & Co.	Olivedene	54 Bbls.	86.60	86.52		.08
" " "	"	35 Bags	86.00	86.30	.30	
" " "	"	4 Trcs.	83.90	84.57	.67	
Bartram Bros.	Alert	2383 Bgs.	97.10	97.33	.23	
Macy, Dunham & Co.	Holstein	144 "	91.50	92.25	.75	
" " " "	"	113 "	93.20	93.40	.20	
" " " "	"	260 "	92.60	92.55		.05
" " " "	Ardandhu	104 "	98.40	98.82	.42	
" " " "	"	336 "	98.10	98.70	.60	
" " " "	"	200 "	97.20	97.55	.35	
" " " "	"	100 "	91.40	92.22	.82	
James Lee & Co.	Holstein	25 Hhds.	90.20	90.75	.55	
" " " "	"	119 Bags	91.85	93.47	1.62	
" " " "	"	752 "	97.80	98.18	.38	

Importer	Vessel	No. of Packages	Settlement Test	Official Test	Difference in favor of Revenue	Difference in favor of Merchant
Armstrong & Co.	Honiton	702 Bags	97.65	98 02	.37	
" " "	"	686 Bags	97.80	98.20	.40	
" " "	"	1414 Bags	97.70	98.07	.37	
" " "	"	462 Bags	96 80	96.87	.07	
" " "	"	2772 Bags	97.85	98.03	.18	
" " "	"	144 Bags	97.40	97.98	.58	
" " "	"	1274 Bags	96.70	97.23	.53	
" " "	"	486 Bags	97.45	97.70	.25	
" " "	"	1454 Bags	96.45	96.75	.30	
" " "	"	1940 Bags	97.	97.08	.08	
" " "	"	2000 Bags	96.55	97.21	.66	
" " "	"	752 Bags	96.55	96.93	.38	
" " "	"	704 Bags	96.40	96.95	.55	
Amer. Sugar Ref. Co	Mascotta	581 Bags	84.95	85.15	.21	
Isayeraft & Co.	Pretoria	300 Bags	88.40	89.22	.82	
" " "	"	300 Bags	90.30	90.56	.26	
" " "	"	220 Bags	89.10	89.20	.10	
Amer. Sugar Ref. Co.	Aldborough	1316 Bags	91.58	92.23	.65	
" " " "	"	2699 Bags	95.70	95.98	.28	
" " " "	"	301 Bags	96.90	97.57	.67	
Czarnikow, McDougall	"	10309 Bags	96.51	96.87	.36	
" "	"	2736 Bags	87.52	88.06	.54	
" "	"	237 Bags	89.	89.20	.20	

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Importer	Vessel	No. of Packages	Settlement Test	Official Test	Difference in favor of Revenue	Difference in favor of Merchant
Amer. Sugar Ref. Co.	Versman	1168 Bkt	96.12	96.20	.08	
" " " "	"	213 Bkt	97.05	97.17	.12	
" " " "	"	231 Bkt	96.50	96.95	.45	
" " " "	"	2134 Bkt	97.07	97.22	.15	
" " " "	"	227 Bkt	96.45	96.90	.45	
" " " "	"	421 Bkt	96.20	96.37	.17	
" " " "	"	315 Bkt	97.80	97.72		.08
" " " "	"	1012 Bkt	97.20	97.16		.04
" " " "	"	412 Bkt	96.45	96.49	.04	
" " " "	"	50 Bkt	96.30	97.03	.73	
" " " "	Vittoria	500 Bags	96 75	91.01	.26	
" " " "	"	400 Bags	91.05	91.53	.48	
" " " "	"	387 Bags	95.80	96.20	.40	
" " " "	"	500 Bags	95.95	96.95	1.00	
Czarnikow, McDougall	Madiana	560 Bags	96.90	96.91	.01	
" "	"	721 Bags	92.60	92.65	.05	
Armstrong & Co.	Tjomo	907 Hhds	91.03	91.21	.18	
" " "	"	4521 Bags	88.30	87.97		.33
" " "	"	3999 Bags	96.85	97 40	.55	
" " "	Honiton	579 Bags	97.40	97.65	.25	
" " "	"	3608 Bags	96.52	96.90	.38	
" " "	"	360 Bags	97.05	97.10	.05	
" " "	"	2242 Bags	96.90	97.31	.41	
" " "	"	1950 Bags	97.85	98.26	.41	
" " "	"	360 Bags	97.05	97.90	.85	

Importer.	Vessel.	No. of Packages.	Settlement Test.	Official Test.	Difference in favor of Revenue	Difference in favor of Merch't.
J. M. Ceballos,	Aldborough	882 Bags	95.65	96.22	.57	
W. R. Grace	Coya	3961 "	97.50	98.33	.83	
Jas. Lee & Co.	Holstein	110 "	91.85	92 35	.50	
J. W. Wilson & Co	"	527 "	90.20	91.45	1.25	
" " " "	"	385 "	92.10	93.02	.92	
Gillespie Bros.	Athos	106 "	91.10	93.62	2.52	
J.W. Wilson & Co.	Holstein	159 "	93.35	94.45	1.10	
Amer. Sugar Ref. Co.	Edith Sheraton	1440 "	93.40	94.72	.32	
" " " "	"	820 "	87.60	87.67	.07	
" " " "	"	579 "	95.95	96.55	.60	
" " " "	Krimpen deLek	1139 Bkts	96.	96.22	.22	
" " " "	"	644 "	96.	96.23	.23	
" " " "	Aldborough	1000 Bags	96.	96.32	.32	
" " " "	"	436 "	96.45	96.96	.51	
" " " "	"	287 "	95.65	97.03	1.38	
" " " "	"	2000 "	95.55	96.28	.73	
" " " "	"	686 "	96.60	97.35	.75	
" " " "	"	2750 "	96.75	97.25	.50	
Jas. Greig	"	1620 "	97.25	97.70	.45	
" "						
J. Sala & Co.	Darlington	51 Hhds	90.10	90.17	.07	
" " " "	"	95 Bags	95.35	96.10	.75	
" " " "	"	94 "	96.55	96.65	.10	
Henry Beste	Aldborough	30 Hhds.	89.60	90.05	.45	
" "	"	20 Bags	96.60	96.75	.15	
" "	"	37 "	80.20	80.00		.20
" "	"	500 "	96.65	96.45		.20
" "	Darlington	178 "	85.20	85.15		.05
Bowerman Bros.	Olivedene	2750 "	96.70	97.25	.55	
James Greig	"	1620 "	97.25	97.70	.45	
" "						

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Importer.	Vessel.	No. of Packages	Settlement Test	Official Test	Difference in favor of Revenue	Difference in favor of Merchant
Amer. Sugar Ref. Co.	Krimpen de Lek	1014 Bkt	97.20	97.47	.27	
" " " "	"	323 "	96.75	96.71		.04
" " " "	"	66 "	95.70	95.99	.29	
" " " "	"	148 "	96.05	96.07	.02	
" " " "	"	293 "	96.20	96 22	.02	
" " " "	"	113 "	96.00	95.95		.05
" " " "	"	487 "	95.75	95.77	.02	
Czarnikow, McD. & Co.	Cora M.	320 Bags	89.10	90.60	1.50	
" " "	Pretoria	340 "	90.30	91.15	.85	
" " "	Olivedene	1320 "	95.45	95.97	.52	
" " "	"	1260 "	96.20	96.98	.78	
" " "	"	900 "	96.20	96.72	.52	
" " "	"	2530 "	96.15	96.97	.82	
" " "	Pr. Wm. V.	1000 "	93.80	94.63	.83	
" " "	" " "	379 "	96.90	97 15	.25	
" " "	" " "	701 "	96.50	96.67	.17	
" " "	Coya	2000 "	96.35	96.85	.50	
Bowerman Bros.	Darlington	1128 "	95.50	95.64	.14	
" "	"	824 "	94.90	95.70	.80	
" "	"	790 "	95.90	95.87	.17	
" "	"	602 "	97.05	97.36	.31	
" "	"	229 "	96.15	96.70	.55	
" "	"	253 "	97.95	88.45	.50	

Importer	Vessel	No of Packages	Settlement Test	Official Test	Difference in favor of Revenue	Difference in favor of Merchant
A. Leuder	Black Heath	28630 Bags	85.30	84.96		.34
Bartram Bros.	Cameo	1621 "	95.17	94.70		.47
" "	"	168 "	87.80	88.70	.90	
A. Leuder	Black Heath	8218 "	84.61	84.05		.56
" "	"	17968 "	85.61	85.58		.03
Bartram Bros.	Biancta	1946 "	94.85	95.80	.95	
Jas. Lee & Co.	Naparina	3330 "	95.53	95.70	.17	
" " " "	"	5671 "	93.23	93.32	.09	
Jas. Greig	"	2694 "	96.44	97.03	.59	
" "	"	1623 "	96.90	97.32	.42	
" "	"	950 "	97.05	97.59	.54	
Czarnikow MacDougall & Co.	Louvinia	5625 "	94.71	94.82	.11	
" " "	"	2086 "	94.71	95.45	.74	
Carter Hawley & Co.	Prince William I	270 "	94.60	94.70	.10	
" " " "	"	90 "	87.15	87.12		.03
Czarnikow MacDougall &Co.	Naparina	1828 "	96.25	96.55	.30	
Jas. Lee & Co.	Ardandhu	97 "	90.80	92 20	1.40	
" " " "	"	186 "	91.20	92 77	1.57	
" " " "	"	95 "	89.80	91.87	1.57	
Armstrong & Co.	Madiana	22 Hhds	88.20	88.52	.32	
" " "	"	160 Bbls	88.70	80.83	2.13	
" " "	Glenafton	4803 Bags	87.45	87.56	.11	
Morewood & Co.	New York	872 "	87.05	88.30	.65	

285.

416

Importer	Vessel	No. of Packages	Settlement Test	Official Test	Difference in favor of Revenue	Difference in favor of Merchan
Elmenhorst & Co.	New York	1222 Bags	95.80	96.02	.22	
Carter Hawley & Co.	Prince William I	600 "	96.20	96 20		
G. H. Howell &Co.	Pretoria	147 Hhds	90.	90.75	.75	
" " " " "	"	117 "	90.	90.		
" " " " "	"	19 "	90.05	90.45	.40	
" " " " "	"	57 "	89.95	90.72	.77	
" " " " "	"	143 "	89.95	90.28	.33	
" " " " "	"	217 "	90.	90 71	.71	
" " " " "	"	1000 "	87.15	88.02	.87	
Bowermann Bros.	Pollock	56 Hhds	88.20	89.15	.95	
" "	"	54 "	88.60	88 75	.15	
Czarnikow	Prince	27 Bags	92.45	93.17	.72	
MacDougall & Co.	William 11	973 "	93.80	95.05	1.25	
" " "	"					
" " "	Madiana	371 "	93.85	94.60	.75	
" " "	"	675 "	96.10	96.30	.20	

Importer	Vessel	No. of Packages	Settlement Test	Official Test	Difference in favor of Revenue	Difference in favor of Merchant
Czarnikow MacDougall & Co.	Leon	1670 bags	94.20	94.32	.12	
" "	"	1650 "	94.15	94.63	.38	
" "	Fontabelle	300 "	88.22	87.95	.27	
" "	"	10 "	89.95	89.55	.40	
" "	Granada	345 "	89.80	88.75	1.05	
" "	"	738 "	83.75	83.65		.10
" "	"	31 "	78.	78.05	.05	
Carter, Hawley & Co	Prince William II	90 "	94.32	93.80	.52	
" "	"	914 "	96.50	97.32	.82	
Czarnikow MacDougall & Co.	Madiana	300 "	92.	93.50	1.50	
Jas. Lee & Co.	Ardanrose	126 "	91.	91.24	.24	
" "	"	102 "	90.60	90.82	.22	
" "	"	35 "	90.25	89.65		.60
" "	"	27 "	87.90	89.52	1.60	
" "	"	50 bags	90.15	90.10		.05
" "	"	126 "	91.	91.24	.24	
L. W. & P. Armstrong	Tjomo	6000 "	86.75	87.07	.32	
" "	"	1228 hgs.	90.	90.19	.19	
Czarnikow MacDougall & Co.	Prince William II	134 bags	9 / 80	92.17	1.37	
" "	"	600 "	91.	92.02	1.02	
" "	"	879 "	90/20	90.35	.15	
" "	"	436 "	89 80	90.22	.42	
" "	"	600 "	96.55	97.27	.72	
" "	"	509 "	96.80	97.55	.75	

287.

418

Importer	Vessel	No. of Packages	Settlement Test	Official Test	Difference in favor of Revenue	Difference in favor of Merch
L. W. & P. Armstrong	St Andrews	783 bags	96.20	97.20	1.00	
" "	"	689 "	96.35	98.25	.90	
" "	"	136 "	96.60	97.87	1.27	
" "	"	225 "	96.35	97.25	.90	
" "	"	448 "	97.25	98.10	.85	
" "	"	578 "	96.50	97.35	.85	
" "	"	200 "	97.30	98.05	.75	
" "	"	2455 "	97.56	97.64	.08	
" "	"	2463 "	96.47	97.05	.58	

Importer	Vessel	No. of Packages	Settlement Test	Official Test	Difference in favor of Revenue	Difference in favor of Merchant
Czarnikow MacDougall & Co.	Olivedene	668 bags	96.30	96.70	.40	
" "	"	1070 "	88.85	89.75	.90	
James Greig	"	2501 "	95.86	96.41	.55	
"	"	3383 "	96.41	96.90	.51	
"	"	91 "	96.15	97.22	1.07	
Czarnikow MacDougall & Co.	Granada	284 "	88.92	89.05	.13	
Meeke & Co.	New York	500 "	94.10	94.82	.72	
L. W. & P. Armstrong	St. Andrews	1814 "	97.	97.19	.19	
" "	"	1554 "	97.25	97.40	.15	
" "	"	541 "	96.90	97.05	.15	
" "	"	927 "	96.85	97.30	.45	
" "	"	540 "	97.30	98.12	.82	
" "	"	1350 "	96.70	96.98	.28	
" "	"	967 "	96.95	97.90	.95	
" "	"	844 "	96.55	96.90	.35	
" "	"	360 "	97.15	98.07	.92	
" "	"	900 "	96.90	97.27	.37	
" "	"	187 "	96.45	97.67	1.22	
" "	"	880 "	96.75	97.40	.65	
" "	"	351 "	97.30	97.82	.52	
" "	"	300 "	97.30	98.22	.92	
" "	"	448 "	97.05	97.92	.87	
" "	"	400 "	96.65	97.05	.40	
" "	"	1081 "	97.25	97.65	.40	

Importer	Vessel	No. of Packages	Settlement Test	Official Test	Difference in favor of Revenue	Difference in favor of Merchant
L. D. P. Armstrong.	Ullef	3150 bags	96.90	97.75	.85	
Middleton & Co.	Jarlsberg	91 hhds	90.10	90.36	.26	
" "	"	16 "	86.05	86.52	.47	
L. D. P. Armstrong,	New York	1355 bags	88.80	88.20		.60
" " " "	" "	1708 "	89.80	87.65		2.15
B. H. Howell & Co.	" "	34 "	94.20	95.85	1.65	
" " " "	" "	34 "	95.75	96.20	.45	
Benj. Perkins,	Jason	344 "	90.25	91.52	1.27	
" "	"	562 "	90.60	91.	.40	
Czarnikow MacDougall & Co	Najarinc	2680 "	96.55	96.90	.35	
" "	"	1828 "	96.25			
John Farr,	Madiana	62 Tres	90 50	90.50		
Bartram Bros.	New York	427 bags	93.35	93.75	.40	
" "	" "	148 "	91.50	93.40	2.90	
" "	" "	764 "	88.60	84.85		3.85
" "	" "	228 "	92.10	92.27	.17	
" "	" "	348 "	88.55	88.35		3.20
" "	" "	56 "	94.50	95.70	1.20	
B. H. Howell & Co.	Madiana	200 bhgs	90.25	90.20		.05
" " " "	"	200 "	90.70	90.41		.29
" " " "	"	157 "	90.05	89.86		.19
Czarnikow MacDougall & Co	Irrawady	1500 bags	93.80	94.85	1.05	
Leaycraft & Co.	Pretoria	874 "	89.80	89.83	.03	

289.

420

Importer	Vessel	No. of Packages	Settlement Test	Official Test	Difference in favor of Revenue	Difference in favor of Merchant
Leaycraft & Co.	Pretoria	628 bags	90.05	90.30	.25	
Czarnikow MacDougall & Co	Orange & Nassau	429 "	88.70	88.61		.09
" " "	"	53 "	89.25	89.37	.12	
Carter, Hawley & Co.	"	19 "	86.90	87.50	.60	.17
" " "	"	38 "	87.07	86.90		
" " "	"	200 "	86.55	86.65	.10	
Czarnikow MacDougall & Co	"	168 "	89.95	90.07	.12	
" "	"	886 "	93.95	95.15	1.30	
" "	"	176 "	90.60	90.85	.25	
" "	"	265 "	90.10	90.42	.32	
" "	"	315 "	90.45	90.82	.37	
Czarnikow MacDougall & Co.	Baldwin	8549 "	96.38	96.82	.44	
Carter, Hawley & Co	Cheslie	5839 "	96.29	96.38	.07	
Lueder	Helen Rickmas	9000 "	94.90	94.95	.05	
Carter, Hawley & Co.	Prince William IV	90 "	95.95	96.85	.90	
" " "	"	60 "	95.95	96.50	.55	
" " "	"	30 "	95.95	95.47	.52	
" " "	"	90 "	95.95	96.67	.72	
J. E. Kerr,	Jason	38 "	87.25	87.80	.55	
L. D. P. Armstrong,	Jarlsberg	950 hhds	90.05	90.		.05
" " " "	"	3338 bags	87.35	87.05		.30
B. H. Howell & Co.	Madiana	275 "	90.60	91 70	1.10	
" " " "	"	136 "	90.05	90.55	.50	

Importer	Vessel	No. of Packages	Settlement Test	Official Test	Difference in favor of Revenue	Difference in favor of Merchant
P. H. Howell & Co.	Madiana	306 bags	90.30	90.75	.45	
" " " "	"	394 "	91.40	94.17	2.77	
" " " "	"	143 "	91.40	92.10	.70	
" " " "	"	372 "	90.60	91.92	1.32	
" " " "	"	527 "	92.15	94.17	2.55	
" " " "	"	781 "	90.90	91.70	.80	
" " " "	"	151 "	93.25	93.50	.25	
" " " "	"	54 "	90.35	91.70	1.35	
" " " "	"	271 "	90.25	90.62	.37	
John Hales	Minnie	1750 "	95.60	96.02	.42	
Benj. Perkins	Fontabelle	21 bbls.	84.40	83.87		53
" "	"	12 "	84.10	85.75	1.65	
" "	"	2 tres.	82.25	83.82	1.57	
" "	"	14 bbls.	84.75	86.87	2.12	
" "	"	38 "	84.70	84.70		
" "	"	38 hhds	85.00	85.52	.52	
" "	"	32 bags	87.25	87.47	.22	
Czarnikow, MacDougall & Co.	Grenada	2084 "	88.92	89.05	.13	
" " "	"	2023 "	89.90	90.80	.90	
" " "	Leon	1670 "	94.20	94.32	.12	
" " "	"	1650 "	94.15	94.63	.48	
" " "	Grenada	345 "	88.75	89.80	1.05	
" " "	"	738 "	83.75	83.65		.10
" " "	"	31 "	78.00	78.02	.02	
" " "	Olivedene	668 "	96.30	96 70	.40	
" " "	"	1070 "	88.85	89.75	.90	
" " "	Prince William II	600 "	96.55	97.27	.72	
" " "	"	509 "	96.80	97.55	.75	
A Lasselles & Co.	Castle Eden	648 "	92.45	93.13	.68	
" " " " "	"	221 bbls.	93.12	92.65		.47

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422

Importer	Vessel	No. of Packages	Settlement Test	Official Test	Difference in favor of Revenue	Difference in favor of Merchant
Arbuckle Bros.	Aquileja	33100 Bags	96.25	95.64		.61
Macy, Dunham & Co.	Ardandhu	15 Bags	96.60	96.80	.20	
" " "	"	51 "	97.30	97.42	.12	
Carter Hawley & Co.	Prince William II	914 "	96.50	97.17	.67	
Macy, Dunham & Co.	Castle Eden	221 Bbls	90.75	91.15	.40	
A. S. Lascelles & Co.	Holstein	20 Bags	86.25	86.92	.67	
Bartram Bros.	Golden Rod	400 "	88.05	87.57		.48
" "	"	1863 "	88.80	89.35	.55	
John Hales	Aretas	3660 "	95.64	95.94	.30	
Outerbridge & Co.	Fontabelle	5 Hhds	87 85	88.97	1.12	
" "	"	47 Bbls	84.05	83.75		.30
" "	"	18 "	80.80	81.45	.65	
" "	"	106 "	86.60	86.60		
Walden & Benheim	Moamo	70 Bags	85.15	84.69		.46
" "	"	280 "	86.95	87.40	.45	
" "	"	140 "	85.10	87.62	2.52	
" "	"	146 "	87.05	86.70		.35
" "	"	350 "	88.60	88.63	.03	
Park Son & Co.	"	97 "	88.70	87.63		1.07
" " "	"	177 "	88 95	88.05		.90
" " "	"	13 Hhds	90.20	90.47	.27	
" " "	"	184 Bags	88.40	87.52		.88
" " "	"	326 "	88.10	88.35	.25	
" " "	"	22 Hhds	88.00	90.20	2.20	
" " "	"	19 "	89.70	89.40		30
" " "	"	462 Bags	87.80	88.42	.62	

Importer	Vessel	No. of Packages	Settlement Test	Official Test	Difference in favor of Revenue	Difference in favor of Merchant
Arbuckle Bros.	Johanna	51 Bkts	95.70	95.27		.43
" "	"	449 "	95.70	95.70		
" "	"	1613 "	94.23	94.67	.44	
" "	"	67 "	93.65	94.15	.50	
" "	"	585 "	94.30	95.60	1.30	
" "	"	1287 "	94 85	95.01	.16	
" "	"	37 "	95.15	95.50	.35	
" "	"	1860 "	94.33	95.13	.80	
		884				
N. Y. Sugar Ref. Co.	Leander	500 Bags	94.30	94.37	.07	
		885				
" " " "	"	500 Bags	94.50	94.40		.10
		886				
" " " "	"	500 Bags	94.00	94.56	.56	
		756				
" " " "	"	500 Bags	94.00	94.35	.35	
		757				
" " " "	"	500 Bags	94.30	94.01		.29
		763				
" " " "	"	500 Bags	93.80	94.22	.42	
Howell Son Co.	Madiana	808 Bags	97.15	97.55	.40	
" " "	"	1428 "	96.55	96.91	.36	
" " "	"	1894 "	97.55	97.49		.06
" " "	"	2354 "	96.50	97.11	.61	
" " "	"	450 "	97.50	98.07	.57	
" " "	"	330 "	97.15	97.25	.10	
" " "	"	585 "	97.50	98.07	.57	
" " "	"	198 "	97.50	98.35	.85	

293.

424

Importer	Vessel	No. of Packages	Settlement Test	Official Test	Difference in favor of Revenue	Difference in favor of Merchant
B. H. Howell & Co.	Fontabelle	1280 Bags	96.66	96.79	.13	
" " " "	"	360 "	97.05	97.05		
" " " "	"	440 "	98.10	98.52	.42	
Ricardo Acosta.	New York	163 "	93.35	94.17	.82	
Lawrenee Turnure	Ravens-dale	178 "	98.08	97.92		.16
" "	"	158 "	98.08	98.27	.19	
" "	"	135 "	84.65	84.70	.05	

Importer	Vessel	No. of Packages	Settlement Test	Official Test	Difference in favor of Revenue	Difference in favor of Merchant
Watson, Toel & Co.	Ardanrose	755 bags	88.75	88.92	.17	
" " "	"	155 "	89.80	90.67	.87	
" " "	"	1000 "	91.70	90.52		1.18
" " "	"	400 "	91.75	90.72		1.03
" " "	"	2179 "	88.50	88.22		.28
" " "	"	318 "	80.90	80.52		.38
" " "	"	2800 "	94.45	95.19	.74	
" " "	"	2148 "	94.05	94.07	.02	
" " "	"	1052 "	86.10	86 53	.43	
" " "	"	740 "	89.85	89.22		.63
" " "	"	196 "	86.55	87.38	.88	
Bartram Bros.	Cameo	1427 "	95.40	96.	.60	
" "	"	132 "	88.70	89.35	.65	
" "	"	40 hhds.	85.95	85 77	.18	
L. D. P. Armstrong	Tjomo	1090 "	89.75	89.70		.05
" " " "	"	5132 "	88.90	88.88		.02
" " " "	"	1016 "	96.80	87.17	.37	
Walden & Benhem	Ardandhn	70 bags	81.30	81.35	.05	
" "	"	15 hhds.	77.40	77.67	.27	
" "	"	1 Tree	77.40	78.57	1.17	

Importer	Vessel	No. of Packages	Settlement Test	Official Test	Difference in favor of Revenue	Difference in favor of Merchant
Benjamin Perkins	Ravensdale	353 bags	98.85	91.40	.55	
Carter, Hawley & Co.	Pr. Fred. Hendricks	120 "	96.50	97.27	.77	
" " " "	"	180 "	96.50	96.95	.45	
Howell, Son & Co.	"	4424 "	94.42	94.85	.43	
" " "	"	1825 "	87.70	88.17	.47	
" " "	"	1851 "	87.35	87.12		.23
" " "	"	1552 "	86.80	85.19		1.71
" " "	"	1260 "	86.75	85.49		1.26
" " "	"	567 "	88.55	87.52		1.03
J. B. Vincini	New York,	899 "	93.55	95.45	.90	
Czarnikow MacDougall & Co.	Mascotta,	1316 "	92.35	92.26		.09
Amer. Sugar Ref. Co.	Stâtheim,	6000 "	97.01	97.43	.42	
" " " "	"	5330 "	98.30	98.69	.39	
" " " "	"	5000 "	97.82	98.	.18	
" " " "	"	4900 "	97.90	98.28	.38	
" " " "	"	1470 "	98.30	98.35	.05	
" " " "	"	600 "	97.65	97.70	.05	
" " " "	"	6400 "	97.15	97.39	.24	

Importer	Vessel	No. of Packages	Settlement Test	Official Test	Difference in favor of Revenue	Difference in favor of Merchant
J. Sala	Vittoria	137 Hhds	87.40			
		13 "	89.60			
		150 "		86 12		1 28
A. M Seixas	St. Andrews	125 Hhds	91.69	92.04	.35	
" " "	" "	990 Bags	91.69	93.57	1.88	
" " "	" "	336 "	95.10	96.15	1.05	
" " "	" "	34 "	92.25	93.65	1.40	
" " "	" "	10 Hhds	91.25	91.27	.02	
		47 "	89.70			
		23 "	90.25			
A. S. Lascelles & Co	" "	20 "	89.90			
				89.77		.23
" " " " "	" "	171 Hhds	88.65	88.44		.21
" " " " "	" "	91 "	88.65	88.97	.32	
" " " " "	" "	70 "	90.80	89.90		.90
" " " " "	" "	27 "	91.95	92.17	.22	
" " " " "	" "	18 "	89.20	87.77		1.43
" " " " "	" "	160 "	90.30	90.52	.22	
" " " " "	" "	82 "	87.95	87.62		.33
" " " " "	" "	39 "	89.10	88.22		.88
" " " " "	" "	54 "	91.65	92.17	.52	
" " " " "	" "	38 "	88.50	86.85		1.60
" " " " "	" "	19 "	87.70	88.92	1.22	
" " " " "	" "	14 "	91.15	90.55		.60
" " " " "	" "	47 "	90.70	91.00	30	
" " " " "	" "	400 Bags	96.40	96.17		.23

Importer	Vessel	No. of Packages	Settlement Test	Official Test	Difference in favor of Revenue	Difference in favor of Merchant.
J. W. Wilson & Co.	Athos	295 Bags	90.45	93.12	2.67	
" " " " "	"	484 "	89.60	90.12	.52	
" " " " "	"	604 "	91.90	92.65	.75	
" " " " "	"	49 "	90.35	91.62	1.27	
" " " " "	"	587 "	90.30	91.72	1.42	
Czarnikow	Prince					
MacDougall & Co.	Mauritz	2400 "	96.30	96.65	.35	
" " "	Madiana	450 "	89.70	90.92	1.22	
" " "	"	30 Hhds	91.00	91.47	.47	
" " "	"	15 "	90.85	91.15	.30	
" " "	"	500 Bags	90.35	91.37	1.02	
" " "	"	20 Hhds	90.20	90.40	.20	
" " "	"	300 Bags	93.95	94.55	.60	
" " "	"	483 "	88.00	89.95	1.95	
" " "	"	33 Hhds	88.60	89.10	.50	
" " "	"	38 Trs	87.25	86.20		1.05
" " "	"	50 "	89.20	88.70		.50
" " "	"	46 "	88.75	87.22		.47
" " "	"	33 "	87.75	86.82		.93
" " "	"	26 Bbls	87.00	85.25		1.75.
A. S. Lascelles & Co.	Ardenrose	236 Hhds	91.35	91.07		.28
" " " " "	"	1088 Bags	96 75	97.20	.45	
" " " " "	"	3329 "	84.70	84.47		.23
" " " " "	"	1288 "	81.75	82.10	.35	
" " " " "	"	57 "	85.85	84 57		1.28

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Importer	Vessel	No. of Packages	Settlement Test	Official Test	Difference in favor of Revenue	Difference in favor of Mercha.
Park & Son	Ardandhu	21 Hhds	85.95	86.57	.62	
A. S. Lascelles & Co.	Tyrian	27 "	90.60	89 85		.75
" " " " "	"	33 "	90.10	91.22	1.12	
" " " " "	"	4 "	86.95	87.77	.82	
Benj. Perkins	Ardandhu	730 Bags	90 00	90.72	.72	
" "	"	280 "	88.70	90.35	.65	
Park & Son	"	95 "	89 00	92.40	3.40	
" " "	"	130 "	88 00	90.10	2.10	
" " "	"	45 "	90 55	91 97	1.42	
James Lee & Co	"	290 "	87.60	87.70	.10	
Gillespie Bros.	"	143 "	90.70	92.50	1.80	
" "	"	140 "	93 75	94.40	.65	
" "	"	27 Bbls.	91.55	90.05		1.50
" "	"	50 "	92.10	93.77	1.67	
" "	"	44 "	93.50	92.12		1.38
Leaycraft & Co.	"	29 Hhds	90.80	90.25		.55
" " "	"	576 Bags	91.10	91.52	.42	
" " "	"	837 "	91.40	91.55	.15	
" " "	"	128 "	91.45	93.97	2.52	
Gillespie Bros.	Athos	43 Trs.	90.00	91.60	1.60	
A. S. Lascelles & Co.	Ardenrose	37 Hhds	91.75	90.27		1.48
" " " " "	Tyrian	22 "	87.40	86.32		1.08
" " " " "	"	53 "	90.05	89.85		.20
" " " " "	"	15 "	86.85	84.25		2.60
" " " " "	"	32 Bags	82.05	81.40		.65

Importer	Vessel	No. of Packages	Settlement Test	Official Test	Difference in favor of Revenue	Difference in favor of Merchant
A. S. Lascelles & Co.	Tyrian	1361 Bags	96.95	96.55		.40
" " " " "	"	1075 "	96.00	96.20	20	
" " " " "	"	919 "	95.00	94.44		.56
" " " " "	"	553 "	94.55	95.55	1.00	
" " " " "	"	713 "	96.50	97.22	.72	
" " " " "	"	72 "	97.95	98.60	.65	
" " " " "	"	150 "	97.45	98.15	.70	
" " " " "	"	1 Bbl.	86.85	89.27	2.42	
" " " " "	"	5 Hhds	89.00	87.55		1.45
" " " " "	"	31 "	89.00	88 87		.13
" " " " "	"	32 "	89.00	89.55	.55	.73
" " " " "	"	12 "	89.00	88.27		.73
" " " " "	"	31 "	89.00	88.00		1.00
A. M. Seixas	Viltoria	420 Bags	90.48	90.10		.38
" " "	"	86 Hhds	90.48	89 94		.54
" " "	"	50 "	88.40	87.53		.97
" " "	"	57 "	88.40	82.85		5.55
" " "	"	58 "	87 65	89.25	1.60	
" " "	"	262 "	87.65	87.49		.16
" " "	"	20 Bags	91.59	88.07		3.52
" " "	"	133 "	91.59	89.90		1.69
" " "	"	755 "	95.35	96.72	1.37	
A. S. Lascelles & Co.	"	131 Hhds	88.25	83.80		4.45
" " " " "	"	60 "	87.40	84.79		2.61
" " " " "	"	371 "	89.00	86.86		2.14

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Importer	Vessel	No. of Packages	Settlement Test	Official Test	Difference in favor of Revenue	Difference in favor of Merchant
A. S. Lascelles & Co.	Vittoria	20 Hhds	89.30	87.20		2.10
" " " "	"	38 "	88.15	88.90	.75	
" " " "	"	391 Bags	97.05	97.15	.10	
James Lee & Co.	Athos	1283 "	90.65	91.80	1.15	
" " " "	"	1426 "	91.95	93.43	1.48	
Gillespie Bros.	Madiana	450 "	98.10	98.30	.20	
J. M. Seixas	St. Andr'	125 Hhds	91.69	92.04	.35	
" "	"	999 Bags	91.69	93.57	1.88	
" "	"	336 "	95.10	96.15	1.05	
" "	"	34 "	92.25	93.65	1.40	
" "	"	10 "	91.25	91.27	.02	

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Importer	Vessel	No. of Packages	Settlement Test	Official Test	Difference in favor of Revenue	Difference in favor of Merchant
A. M. Seixas	St. Andrews	100 Hhds	90.46	88.31		2.15
" " "	"	111 "	90.46	91.23	.77	
" " "	"	6 "	90.46	90.42		.04
" " "	"	65 "	90.46	91.55	1.09	
" " "	"	60 "	90.46	87.47		2.99
" " "	"	25 "	90.46	90.07		.39
" " "	"	16 "	90.46	89.87		.59
" " "	"	1000 Bags	96.75	97.00	.25	
" " "	"	400 "	80.79	81.35	.56	
" " "	"	400 "	80.79	86.37	5 58	
" " "	"	100 "	80.79	79.35		1.44
Park & Son	Ardandhu	45 "	90.55	91.97	1.42	
A. S. Lascelles & Co.	Ardenrose	236 Hhds	91.35	91.07		.28.
" " " " "	"	1088 Bags	96.75	97.20	.45	
" " " " "	"	3329 "	84.70	84.47		.23
" " " " "	"	1288 "	81.75	82.10	.35	
" " " " "	"	57 "	85.85	84.57		1.28
" " " " "	"	37 "	91.75	90.27		1.48
Park & Son	Jason	513 "	90.25	90.67	.42	
James Lee & Co.	Ardandhu	97 "	90.80	92.20	1.40	
" " " "	"	186 "	91.20	92.77	1.57	
" " " "	"	95 "	89.80	91.37	1.57	
Leyeraft & Co.	Holstein	201 "	86.45	87.12	.67	
" " "	"	620 "	92.05	92.80	.75	

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Importer	Vessel	No. of Packages	Settlement Test	Official Test	Difference in favor of Revenue	Difference in favor of Merch
Gillespie Bros.	Holstein	136 Bags	94.35	93.45		.90
Benj. Perkins	"	156 "	90.55	91.19	.64	
" "	"	1 "	93.15	92.35		.80
" "	Ardandhu	730 "	90.10	90.72	.62	
" "	Cora M	400 "	89.00	89.50	.50	
" "	"	560 "	88.80	89.10	.30	
Bartram Bros.	Pretoria	60 Bbls	88.05	88.05		
" "	"	30 "	84.35	85.72	1.37	
Czarnikow MacDougall & Co	Cora M	320 Bags	88.80	90.65	1.85	
Park & Son	"	435 "	89.35	89.60	.25	
Middleton & Co.	Pretoria	33 Bbls	85.55	87.15	1.60	
J. M. Ceballos & Co.	Coya	90 Bags	93.95	94.37		.42
Fred Probst	"	1125 "	95 90	96.92	1.02	
" "	"	359 "	93.50	96 92	3.42	
" "	"	1492 "	84.95	85.15	.50	
Middleton & Co.	Pretoria	40 "	92.80	91.15		1.65
Park & Son	"	36 Hhds	86 65	86.60		.05
" " "	"	20 "	90.20	91.12	.92	
" " "	"	40 "	88.15	89.25	1.10	
" " "	"	10 "	87.75	86 92		.83
" " "	"	119 Bags	88.95	90.92	.97	
" " "	"	50 Bbls	87.95	90.00	2.05	
Czarnikow MacDougall & Co.	"	90 Hhds	89.60	89.65	.05	
" " "	"	340 Bags	90.50	91.15	.65	

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Importer	Vessel	No. of Packages	Settlement Test	Official Test	Difference in favor of Revenue	Difference in favor of Merchant
Gillespie Bros.	Pretoria	16 Hhds	90.75	89.70		1.05
" "	"	27 "	90.60	89.65		.95
" "	"	160 Bags	89.40	90.20	.80	
Benj. Perkins	"	80 Hhds	91.45	89.50		1.95
Czarnikow MacDougall & Co.	Caribbee	65 Trs	73.00	72.00		1.00
Czarnikow MacDougall & Co.	"	96 Bbls	78.20	78.07		.13
Czarnikow MacDougall & Co.	"	45 Hhds	94 30	94.71	.41	
Czarnikow MacDougall & Co.	"	52 Bags	95.30	95 10		.20
Czarnikow MacDougall & Co.	J. W. Taylor	152 Hhds	90.80	90.67		.13
Benj. Perkins	Athos	1160 Bags	92.15	93.02	.87	
J. B. Vicini & Co.	New York	400 "	97.25	98.13	.88	
" " " " "	"	1026 "	95.70	96.50	.80	
" " " " "	"	899 "	95.90	96.45	.55	
Park & Son	Jason	15 Trs	88.55	89.10	.55	
Benj. Perkins	Athos	816 Bags	90.85	92.07	1.22	
Gillespie Bros.	"	42 Trs	90.00	91.50	1.50	
Carter Hawley & Co.	Prince Mauritz	800 Bags	95.15	95.38	.23	
James Lee & Co.	Ardandhu	97 "	90.80	92.36	1.56	
" " " "	"	186 "	91.20	93.25	2.05	
" " " "	"	95 "	89.80	91.54	1.74	
Benj. Perkins	Holstein	354 "	88.00	88.96	.96	
"	Athos	536 "	88.70	90.94	2.24	
R. H. Howell	Frederick der Grosse	500 "	94.00	93.72		.28
" " "	"	500 "	94.50	94.42		.08

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Importer	Vessel	No. of Packages	Settlement Test	Official Test	Difference in favor of Revenue	Difference in favor of Merch.
B. H. Howell	Frederick	Z A 57				
" " "	der Grosse	500 bags	94.10	93.93		.17
	" "	Z A 59				
" " "		500 bags	92.80	92.47		.33
	Barbarossa	W C 13				
" " "		843 bags	94.70	93.90		80
	"	E 1 0 "	94 90	95.12	.22	
" " "	New York	D 400 "	94.95	96.25	1.30	
" " "	Consuelo	363 "	95 90	97.20	1.30	
" " "	Colon	184 "	95.10	95.25	.15	
Czarnikow, McD & Co.	Pretoria	Wade H				
		1400 Hhds	90.90	91.40	.50	
" " "	"	G W				
		13 "	95.30	95.45	.15	
" " "	Caribbee	C C				
		500 bags	96.40	96.70	.30	

Importer	Vessel	No. of Packages	Settlement Test	Official Test	Difference in favor of Revenue	Difference in favor of Merchant
Benjamin Perkins	America	370 bags	92.55	92.40		.15
Carter Hawley	Prince Mauritz	135 "	88.25	88.17		.08
Mosle Bros.	Karthago	200 "	96.20	96.35	.15	
" "	"	200 "	95.20	94.82		.38
B. H. Howell	Scythia	831 "	96.90	97.65	.70	
" " "	"	1200 "	96.40	96.87	.47	
" " "	"	177 "	95.95	96.90	.95	
" " "	"	55 "	96.20	97.20	1.00	
" " "	Madiana	520 "	96.70	96.67		.03
" " "	"	1140 "	97.15	97.22	.07	
" " "	"	584 "	96.55	96.62	.07	
" " "	"	1352 "	96.80	96.70		.10
" " "	"	400 "	97.00	97.22	.22	
J. M. Ceballos & Co.	Advance	1171 "	97.00	97.80	.80	
" " " "	"	248 "	88.90	88.80		.10
Arbuckle Bros.	Eiffel Tower	11668 bags	97.04	96.83		
B. H. Howell	Zanzibar	500 bags	94.70	94 70		
" " "	"	500 "	94.70	94.42		.28
" " "	"	500 "	95.20	94.37		.83
" " "	"	500 "	94 90	94.37		.53
" " "	"	500 "	94.30	94.15		.15
G. Amsink	Karthago	731 "	93.60	93.70	.10	
" "	"	97 "	91.15	91.30		.15
Leaycraft	Madiana	14 Hhds.	85 75	85.40		.35
Leaycraft	Jason	31 bags	87.00	87.60	.60	
"	"	16 bbls	79.50	79.62	.12	
Mosle Bros.	Lord Warwick	30000 bgs	97.41	97.50	.09	

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Importer	Vessel	No. of Packages	Settlement Test	Official Test	Difference in favor of Revenue	Difference in favor of Merchant
Czarnikow MacDougall & Co.	Caribbee	500 Bags	96.40	96.70	.30	
B. H. Howell & Co	Frederick der Grosse	WCB 1011	94.50	94.35		.15
" " " " "	"	" 1091	94.50	94.42		.08
" " " " "	"	" 1135	94.00	93.87		.13
" " " " "	"	" 1136	94.00	93.92		.08
" " " " "	"	" 844	93.80	94.15	.35	
" " " " "	"	" 847	94.50	94.52	.02	
" " " " "	"	" 1090	94.50	94.17		.33
" " " " "	"	" 1130	94.00	93.94		.06
" " " " "	"	" 1131	94.00	93.67		.33
" " " " "	"	ZA 56	94.50	94.37		.13
" " " " "	"	" 58	94.20	93.87		.33
" " " " "	"	ZE 60	94.80	94.96	.16	
" " " " "	"	" 61	94.80	94.82	.02	
" " " " "	"	" 65	94.50	94.35		.15
Czarnikow MacDougall & Co.	Pretoria	18 Hhds	90.85	88.85		2.00
" " "	"	72 Bbls	88.00	88.70	.70	
" " "	"	80 "	83.75	81.40		2.35
" " "	"	52 "	82.75	84.00	1.25	
" " "	"	20 "	86.60	87.00	.40	
" " "	"	214 "	87.90	88.26	.36	
" " "	"	24 "	87.85	87.10		.75
" " "	"	13 "	89.60	89.20		.40
" " "	"	59 "	82.70	81.65		1.05
" " "	"	18 Bags	87.15	86.05		1.10

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Importer	Vessel	No. of Packages	Settlement Test	Official Test	Difference in favor of Revenue	Difference in favor of Merchant
Czarnikow						
Mac Dougall & Co.	Pretoria	1 Trs	82.70	83.17	.47	
Bartram Bros.	"	14 Hhds	90.35	90.67	.32	
" "	"	3 Bbls	90.35	90.85	.50	
" "	"	5 Hhds	88.00	89.45	1.45	
" "	"	5 Bbls	83.90	85.85	1.95	
" "	"	20 Hhds	89.65	90.45	.75	
Muller Schall & Co.	Ravensdale	184 Bags	97.25	97.27	.02	
" " " "	"	130 "	96.30	96.35	.05	
Fred. Probst	Capic	624 "	93.45	94.87	1.42	
" "	"	94 "	87.80	88.77	.97	
" "	"	338 "	93.25	95.05	1.80	
Leaycraft & Co.	Naparina	35 Bbls	83.75	84.35	.60	
" " "	"	19 Bags	86.95	81.15		5.80
A. E. Irving	Mary Stuart	620 "	87.15	86.30		.85
Middleton & Co.	Dominick	7947 "	89.25			
" " "	"	75 Hhds	90.30	90.25		.05
" " "	"	25 "	90.70	90.50		.20
John Farr .	Pretoria	310 Bags	90.85	91.25	.40	
Leaycraft & Co.	Irrawaddy	15 Bbls	82.60	82.25		.35
" " "	"	28 "	79.30	84.55	5.25	
" " "	"	16 "	83.75	84.22	.47	
" " "	"	5 "	81.85	81.67		.18
" " "	"	2 "	83.45	83.60	.15	
" " "	"	5 "	77.15	81.67	4.52	
" " "	"	56 Bags	85.40	86.37	.97	

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Importer	Vessel	No. of Packages	Settlement Test	Official Test	Difference in favor of Revenue	Difference in favor Merchan
Leaycraft & Co.	Irrawaddy	522 Bags	95.25	96.47	1.22	
John Farr	Pretoria	306 "	87.00	87.00		
" "	"	17 Hhds	82.60	81.15		1.45
Armstrong & Co.	Uller	756 Bags	97.85	98.40	.55	
" " "	"	676 "	98.35	98.25		.10
" " "	"	1100 "	97.75	97.73		.02
" " "	"	595 "	97.75	98.12	.37	
" " "	"	780 "	97.80	98.10	.30	
" " "	"	610 "	98.55	98.12		.43
" " "	"	1532 "	97.35	97.84	.49	
" " "	"	750 "	97.50	97.35		.15
" " "	"	540 "	97.65	98.07	.42	
" " "	"	185 "	97.55	98.61	1.06	
" " "	"	324 "	97.75	97.85	.10	
" " "	"	1296 "	97.80	97.75		.05
" " "	"	400 "	97.80	98.12	.32	
Muller, Schall & Co.	Ravensdale	295 "	97.75	97.90	.15	
" " " "	"	114 "	97.30	97.85	.55	
Benj Perkins	Pretoria	80 Hhds	91.45	89.50		1.95
Bartram Bros.	Curacoa	781 Bags	95.45	96.22	.77	
" "	"	1719 "	96.35	96.82	.47	
Muller, Schall & Co.	Ravensdale	575 "	90.30	90.52	.22	
" " " "	"	260 "	94.75	94.62		.13
" " " "	"	239 "	93.20	93.45	.25	
Benj. Perkins	Madiana	60 Hhds	89.25	89.70	.45	

Importer	Vessel	No. of Packages	Settlement Test	Official Test	Difference in favor of Revenue	Difference in favor of Merchant
Gillespie Bros.	Hildebrand	321 Bgs	85.65	84.12		.53
" "	"	20 Hhd	89.85	90.57	.72	
" "	"	20 "	88.50	88.27		.23
Leaycraft & Co.	Jason	120 Bgs	85.85	84.07		1.78
J. M. Ceballos & Co.	Darlington	1746 "	94.80	95.82	1.02	
" " " " "	"	800 "	96.30	96.36	.06	
" " " " "	"	203 "	89.65	90.52	.87	
" " " " "	"	200 "	89.60	90.55	.95	
" " " " "	"	100 "	90.50	90.20		.30
W. R. Grace	Cacique	908 "	96.45	97.63	1.18	
" " "	"	1635 "	96.60	97.01	.41	
" " "	"	2250 "	96.40	97.18	.78	
" " "	"	3968 "	97.75	98.23	.53	
Bartram Bros.	Sierra	1810 "	89.90	90.35	.45	
B. H. Howell	New York	112 "	95.95	96.10	.15	
" " "	" "	457 "	95.95	95.57		.38
" " "	" "	21 "	95.95	95.30		.65
" " "	" "	347 "	95.95	96.35	.90	
Muller, Schall & Co.	Keewayden	165 Hhd	88.25	88.50	.25	
" " " "	"	897 Bags	93.65	94.30	.65	
Macy, Dunham & Co	Castle Eden	168 Bbl	90.55	90.35		.20
" " " "	"	329 "	91.55	91.41		.14
" " " "	"	674 "	90.65	91.35	.70	

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Importer	Vessel	No. of Packages	Settlement Test	Official Test	Difference in favor of Revenue	Difference in favor of Merchan
	Castle					
Gillespie Bros.	Eden	1000 Bgs	96.70	97.19	.49	
" "	"	1380 Bbl	91.10	91.30	.20	
" "	"	1789 Bgs	90.35	91.65	1.30	
" "	"	372 "	90.05	90.60	.55	
" "	"	651 "	90.40	91.35	.95	
" "	"	90 Bbl	88.50	89.50	1.00	
" "	"	150 "	86.00	85.79		.21
" "	"	131 Bgs	86.35	86.51	.16	
" "	"	350 "	86.35	86.51	.16	
" "	"	557 "	86.35	86.51	.16	
" "	Fontabelle	98 "	83.85	83.57		.28
" "	"	118 "	86.30	87.02	.72	
" "	"	24 "	86.30	87.20	.90	
" "	"	47 "	86.50	86.27		.23
" "	"	132 "	85.85	86.90	1.05	
" "	"	45 "	85.60	86.40	.80	
" "	"	83 "	86.55	87.10	.55	
" "	"	28 "	86.70	87.72	.02	
	Castle					
" "	Eden	581 "	96.65	97.55	.90	
" "	"	589 "	96.75	97.20	.45	
Lascelles & Co.	"	648 "	92.45	93.13	.68	
" " "	"	221 Bbl	92.65	93.12	.47	
Middleton & Co.	Fontabelle	49 Hhd	88.85	89.17	.32	
" " "	"	28 "	87.40	88.05	.65	

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Importer	Vessel	No. of Packages	Settlement Test	Official Test	Difference in favor of Revenue	Difference in favor of Merchant.
Middleton & Co.	Fontabelle	19 Bbl	86.75	85.10		1.65
" "	"	10 "	87.00	87.97	.97	
Leayeraft & Co.	Madiana	25 Hhd	88.50	88.20		.30
" "	"	20 "	89.15	89.47	32	
" "	"	20 "	87.55	87.87	32	
" "	"	19 "	86.95	86.65		.30
" "	"	25 "	90.90	90.50		.40
" "	"	20 "	81.00	80.80		.20
" "	"	9 "	88 55	88.45		.10
" "	"	20 "	88.00	87.50		.50
" "	"	11 "	89.15	88.82		.33
" "	"	20 Bbl	80.10	79.60		.50
" "	"	10 Hhd	87.30	87.17		.13
" "	"	97 Bbl	88.20	87.72		.48
" "	"	26 "	83.60	83.87	.27	
Bartram Bros.	Emma R. Smith	4605 Bgs	94.90	95.35		
" "	"	120 "	87.95	88.10	.15	
Leayeraft & Co.	Moamo	6 "	84.75	85.07	.32	
" "	"	136 "	88.50	88.52	.02	
" "	"	7 Hhd	90.15	89.47		.68
" "	"	4 "	89.30	90.22	.92	
" "	"	331 Bgs	86.05	86.60	.55	
Middleton & Co.	Fontabelle	130 Bbl	84.40	84.72	.32	

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Importer	Vessel	No. of Packages	Settlement Test	Official Test	Difference in favor of Revenue	Difference in favor of Merchant
James Lee & Co.	Ardenrose	35 Bags	90.25	90.65	.40	
Leaycraft & Co.	Madiana	25 Bbls	87.20	87.17		.03
" " "	"	987 "	86.15	85.75		.40
Middleton & Co.	"	82 Hhds	81.55	82.70	1.15	
" " "	"	25 "	85.45	85.97	.52	
" " "	"	101 Bbls	84.70	84.95	.25	
" " "	"	101 "	81.05	79.05		2.00
Park Son & Co.	"	33 Hhds	88.35	88.42	.07	
" " " "	"	30 "	89.80	90.00	.20	
" " " "	"	17 "	82.80	82.45		.35
" " " "	"	75 "	88.50	88.40		.10
J. M. Ceballos & Co.	Pollock	8 "	86.25	85.87		.38
" " " " "	"	1 "	87.20	89.27	2.07	
" " " " "	"	31 "	88.20	89.55	1.35	
" " " " "	"	40 "	89.90	91.50	1.60	
" " " " "	"	13 "	83.85	88.62	4.77	
" " " " "	"	49 "	88.80	87.57		1.23
John Farr	Madiana	490 Bags	89.35	90.25	.90	
B. H. Howell & Co.	Origen	200 Hhds	90.30	90.62	.32	
" " " " "	"	200 "	90.40	90.81	.41	
" " " " "	"	75 "	90.40	90.26		.14
Leaycraft & Co.	Madiana	10 Bbls	87.15	84.85		2.30
" " "	"	67 "	83.20	84.77	1.57	
" " "	"	54 "	86.20	86.55	.35	
" " "	"	120 "	86.60	86.42		.18

Importer	Vessel	No. of Packages	Settlement Test	Official Test	Difference in favor of Revenue	Difference in favor of Merchant
Leaycraft & Co.	Madiana.	57 Bbls	88.90	99.10	1.20	
" " "	"	142 "	86.35	87.01	.66	
" " "	"	75 Bags	87.00	87.55	.55	
" " "	"	100 "	91.00	91.27	.27	
Park Son & Co.	Fontabelle	30 Hhds	87.70	87.35		.35
" " " "	"	36 "	88.70	89.10	.40	
" " " "	"	16 "	87.10	87.60	.50	
Czarnikow						
Mac Dougall & Co.	"	3 "	89.45	89.57	.12	
" " "	"	6 Bags	90.30	90.17		.13
Middleton & Co.	"	83 Hhds	88.60	89.52	.92	
" " "	"	75 Bbls	86.85	87.20	.35	
Park Son & Co.	Canaria	4342 Bags	86.00	86.61	.61	
Benj. Perkins	Ardandhu	40 Hhds	88.15	87.20		.95
" "	"	19 "	86.55	86.90	.45	
" "	"	17 "	90.25	89.27		.98
Bartram Bros.	Cameo	30 "	87.05	87.80	.75	
Benj. Perkins	Moamo	1082 Bags	87.90	87.25		.65
Wilson & Co.	Castle Eden	1613 "	91.50	92.00	.50	
" " "	"	188 "	89.15	89.45	.30	
" " "	"	30 "	88.90	87.95		.95
Park Son & Co.	Fontabelle	19 Bbls	85.10	85.12	.02	
" " " "	"	9 "	84.40	83.87		.53
Leaycraft & Co	"	37 "	87.05	86.70		.35
" " "	"	6 "	85.30	82.37		2.93
" " "	"	28 Hhds	88.40	88.15		.25

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Importer	Vessel	No. of Packages	Settlement Test	Official Test	Difference in favor of Revenue	Difference in favor of Merch.
Bowerman Bros.	Pollock	187 Bags	95.85	96.57	.72	
B. H. Howell & Co.	Origen	2590 "	88.00	87.74		.26
Amsink & Co.	Venturia	361 "	95.70	96.80	1.10	
" " "	"	95 "	94.95	95.90	.90	
" " "	"	108 "	95.65	95.43		.17
" " "	"	60 "	96.15	96.40	.25	
Flint, Eddy & Co.	"	1115 "	95.50	96.42	.92	
" " " "	"	145 "	95.95	96.80	.85	
" " " "	"	240 "	89.80	89.85	.05	
Benj. Perkins	Madiana	35 Hhds	89.25	88.72		.53
Leaycraft & Co.	"	85 "	87.90	89.15	1.25	
" " "	"	32 Bbls	89.40	89.65	.25	
Flint, Eddy & Co.	Venturia	470 Bags	95.40	96.70	1.30	
Hugh Kelly	Amrum	5405 "	94.84	95.41	.57	
" "	"	1005 "	85.20	87.00	1.80	
Gillespie Bros.	Ardenrose	200 "	92.55	92.55		
" "	Olivedene	50 Bbls	84.80	85.42	.62	
" "	"	50 "	83.75	84.00	.25	
" "	"	50 "	84.60	85.95	1.35	
Carter Hawley & Co.	Prince William II	90 "	93.80	94.67	.87	
" " " "	"	914 "	96.50	97.17	.67	
Gillespie Bros.	Madiana	256 "	86.85	86.85		
Benj. Perkins	Ardenrose	26 "	91.20	91.35	.15	
James Lee & Co.	"	126 "	91 00	90.72		.28
" " " "	"	27 "	87.90	89.52	1.62	

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Importer	Vessel	No of Packages	Settlement Test	Official Test	Difference in favor of Revenue	Difference in favor of Merchant
	Hill					
Bowermann Bros.	Pollock	1166 Bags	96.10	96.42	.32	
" "	"	500 "	90.20	91.00	.80	
W. Hawes & Co.	Louvinia	3266 "	77.75	79.31	1.56	
James Lee & Co.	Ardenrose	102 "	90.60	90.82	.22	
Ansinck & Co.	Bartholdi	3105 "	96.15	96.42	.27	
Morewood & Co.	Madiana	465 "	97.05	97.70	.65	
" " "	"	257 "	90.45	91.67	1.22	
Czarnikow	Prince					
MacDougall & Co	William II	609 "	96.55	97.27	.72	
" " "	"	509 "	96.80	97.55	.75	
" " "	"	134 "	90.80	92.17	1.37	
" " "	"	600 "	91.00	92.02	1.02	
" " "	"	228 "	88.90	88.77		.13
" " "	"	879 "	90.20	90.35	.15	
" " "	"	447 "	89.40	86.77		2.63
" " "	"	436 "	89.80	90.22	.42	
" " "	Madiana	300 "	92.00	93.50	1.50	
" " "	Olivedene	668 "	96.30	96.70	.40	
" " "	"	1070 "	88.85	89.75	.90	
Bowermann Bros.	Pollock	18 Hhds	89.40	88.77		.63
" "	"	38 "	90.65	90.65		
" "	"	35 "	89.30	90.22	.92	
" "	"	70 "	90.70	90.20		.50
" "	"	500 Bags	94.30	94.45	.15	
" "	"	60 "	93.35	94.57	1.22	
" "	"	325 "	96.20	95.95		.25

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Importer	Vessel	No. of Packages		Settlement Test	Official Test	Difference in favor of Revenue	Difference in favor of Mercha.
Outerbridge & Co	Madiana	20	Bbls	86.90	85.92		.93
" " "	"	122	"	83.55	82.82		.73
" " "	"	181	"	84.30	87.02	2.72	
" " "	"	104	"	85.30	85.86	.56	
" " "	"	16	Trs	85.85	84.82		1.03
Mecke & Co.	New York	500	Bags	95.90	95.54		.36
Czarnikow Mac Dougall & Co.	Prince William H	1380	"	88.90	89.64	.74	
" " "	"	320	"	88.60	89.35	.75	
Walden & Benham	Ardenrose	2	Hhds	84.30	85.90	1.60	
" " "	"	21	Bbls	85.40	84.57		.83
Bowerman Bros.	Hill Pollock	577	Bags	92.80	93.20	.40	
" "	"	141	"	87.85	88.30	.45	
" "	"	734	"	95.45	95.40		.05
" "	"	381	"	95.85	95.92	.07	
" "	"	63	"	89.40	91.07	1.67	
" "	"	104	"	89.45	90.45	1.00	
" "	"	22	Hhds	90.35	90.10		.25
" "	"	15	"	87.92	90.00	2.08	
" "	"	94	"	87.65	86.97		.63
" "	"	22	"	84.80	85.30	.50	
" "	"	80	"	85.90	86 10	.20	
" "	"	60	"	90.30	89.85		.45
" "	"	7	"	89.15	89.50	.35	
" "	"	1000	Bags	95.10	95.44	.34	
" "	"	293	"	95.65	95.50		.15

Importer	Vessel	No. of Packages	Settlement Test	Official Test	Difference in favor of Revenue	Difference in favor of Merchant
L. W. & P. Armstrong	St. Andr's	783 Bags	96.20	97.70	1.50	
" " " "	"	639 "	97.35	98.17	.82	
Waldon & Benham	Ardenrose	201 "	86.35	87.10	.75	
Benj. Perkins	Ardandhu	19 Hhds	86.55	86.90	.35	
Gillespie Bros.	Olivedene	80 Bags	82.50	82.12		.38
James Greig	"	2501 Bags	95.86	96.41	.55	
" "	"	3383 "	96.41	96.90	.49	
" "	"	91 "	96.15	97.22	1.07	
Bartram Bros.	Cameo Knight	30 Hhds	87.05	87.80	.75	
A. Lender	Errant	CO 120	94.10	94.12	.02	
" "	"	CO 121	94.10	94.05		.05
" "	"	CO 393	94.10	93.85		.25
" "	"	CO 400	94.10	94.25	.15	
" "	"	CO 402	94.10	93.85		.25
" "	"	CO 404	94.10	94.10		
" "	"	CO 405	94.10	93.67		.43
" "	"	CO 403	94.10	93.67		.43
" "	"	FAN 706	94.10	93.12		.98
" "	"	FAN 707	94.10	93.40		.70
" "	"	FAN 708	94.10	93.10		1.00
" "	"	ZFG 164	94.10	94.60	.50	
" "	"	ZFG 166	94.10	94.17	.07	
Outerbridge & Co	Madiana	180 Bags	85.55	86.80	1.25	
" "	"	154 "	87.90	88.70	.80	
" "	"	203 "	85.55	88.50	2.95	

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Importer	Vessel	No. of Packages	Settlement Test	Official Test	Difference in favor of Revenue	Difference in favor of Merch't
James Lee & Co.	Congo	14 Bags	87.90	86.77		1.13
A. Leuder	Knight Errant	ZSA 140	94.10	93.42		.68
" "	"	ZW 52	94.10	94.17	.07	
" "	"	ZW 53	94.10	93.87		.23
" "	"	ZW 54	94.10	93.80		.30
" "	"	ZW 55	94.10	94.05		.05
" "	"	ZW 56	94.10	93.95		.15
A. W. & P. Armstrong	St. Andr's	1814 Bags	97.00	97.19	.19	
" " " "	"	1554 "	97.25	97.40	.15	
" " " "	"	2455 "	96.90	97.64	.74	
" " " "	"	541 "	96.90	97.05	.15	
" " " "	"	927 "	96.85	97.30	.45	
" " " "	"	540 "	97.30	98.12	.82	
" " " "	"	1350 "	96.70	96.98	.23	
" " " "	"	967 "	96.95	97.98	1.03	
" " " "	"	844 "	96.55	96.97	.42	
" " " "	"	360 "	97.15	98.05	.90	
" " " "	"	900 "	96.90	97.11	.21	
" " " "	"	187 "	96.45	97.65	1.20	
" " " "	"	880 "	96.75	97.51	.76	
" " " "	"	351 "	97.30	98.05	.75	
" " " "	"	300 "	97.30	98.22	.92	
" " " "	"	448 "	97.05	97.70	.65	
" " " "	"	400 "	96.65	97.27	.62	
" " " "	"	1031 "	97.25	97.56	.31	

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Importer	Vessel	No. of Packages	Settlement Test	Official Test	Difference in favor of Revenue	Difference in favor of Merchant
A. S. Lascelles & Co.	Hill Pollock	310 Hhds	89.72	88.53		1.19
" " " " "	"	41 "	91.50	90.90		.60
L. W. & P. Armstrong	St. Andrews	136 Bags	96.60	97.42	.82	
" " " "	"	448 "	97.25	97.62	.37	
" " " "	"	225 "	96.35	96.72	.37	
" " " "	"	588 "	96.50	96.80	.30	
" " " "	"	200 "	97.30	97.93	.63	
Gillespie Bros.	Grenada	16 Bbls	80.15	80.97	.82	
A. S. Lascelles & Co	Hill Pollock	53 Hhds	85.45	84.50		.95
" " " " "	"	57 "	89.40	88.45		.95
" " " " "	"	138 "	89.90	88.00		1.90
" " " " "	"	194 "	94.15	94.15		
" " " " "	"	80 "	95.65	96.45	.80	
" " " " "	"	44 "	89.55	87.80		1.75
" " " " "	"	41 "	89.20	86.92		2.28
" " " " "	"	21 "	90.75	87.25		3.50
" " " " "	"	52 "	86.95	84.92		2.03
" " " " "	"	9 "	85.70	84.50		1 20
Bartram Bros.	Cameo	25 "	90.25	90.95	.70	
" "	"	15 "	89.85	90.07	.22	
" "	"	3 Bbls	89.20	89.90	.70	
Carter Hawley & Co.	Prince William	270 Bags	94.60	95.12	.52	
" " " "	"	90 "	87.15	87.12		.03
James Lee & Co.	Congo	211 "	89.50	88.52		.98
" " "	"	36 "	87.75	87.57		.18

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Importer	Vessel	No. of Packages	Settlement Test	Official Test	Difference in favor of Revenue	Difference in favor of Merchant
B. H. Howell & Co	Aragonia	S 124	93.50	93.67	.17	
" " " " "	"	S 126	93.80	94.07	.27	
" " " " "	"	S 144	93 50	93.21		.29
" " " " "	"	S 147	94.10	93.65		.45
" " " " "	"	S 148	93.40	93.65	.25	
" " " " "	"	S 150	93.50	93.75	.25	
" " " " "	"	S 153	93.80	94.03	.23	
" " " " "	Nordkyn	D 44	94.70	95.40	.70	
" " " " "	"	D 45	94 70	94.77	.07	
" " " " "	"	D 46	94 70	94.87	.17	
" " " " "	"	D 1042	94.20	94.37	.17	
" " " " "	"	ZN 162	94.40	94.27		.13
" " " " "	"	ZN 163	94.40	94.45	.05	
" " " " "	"	ZN 164	94.40	94.72	.32	
" " " " "	"	ZN 165	94.40	94.85	.45	
" " " " "	"	ZN 166	94.70	94.77	.07	
" " " " "	"	ZN 167	94.60	94.67	.07	
A. S. Lascelles & Co.	Hill Pollock	102 Hhds	92.25	91.27		.98
" " " " "	"	310 "	89.72	88.53		1.19
" " " " "	"	41 "	91.50	90.90		.60
L. W & P. Armstrong	St. Andrews	136 Bags	96.60	97.42	.82	
" " " "	"	448 "	97.25	97.62	.37	
" " " "	"	225 "	96.35	96.72	.37	
A. S. Lascelles & Co.	Hill Pollock	102 Hhds	92.25	91.27		.98

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Importer	Vessel	No. of Packages	Settlement Test	Official Test	Difference in favor of Revenue	Difference in favor of Merchant
Czarnikow Mac Dougall & Co.	Congo	250 Bags	90.45	92.60	2.15	
Middleton & Co.	Madiana	30 Bbls	89.00	88.50		.50
" " "	"	142 "	86.85	87.05	.20	
Muller, Schall & Co.	Hill Pollock	57 Hhds	87.85	88.10	.25	
" " " "	"	117 "	87.15	87.52	.37	
" " " "	"	181 Bags	89.85	90.00	.15	
" " " "	"	9 "	97.50	97.15		.35
" " " "	"	49 "	97.50	97.75	.25	
" " " "	"	38 "	91.15	92.00	.85	
" " " "	"	227 "	92.00	92.10	.10	
Amsinck & Co.	Bartholdi	1280 "	96.45	97.02	.57	
Bowermann & Co.	Pollock	13 Hhds	82.40	83.65	1.25	
" " "	"	15 "	88.35	86.60		1.75
" " "	"	8 "	88.55	86.60		1.95
" " "	"	22 "	87.40	88.15	.75	
" " "	"	22 "	87.70	87.30		.40
Benj. Perkins	Congo	500 Bags	88.80	88.25		.55
Bartram Bros.	New York	6800 "	95.80	95.93	.13	
B. H. Howell & Co.	Aragonia	S 100 "	93.60	93.52		.08
" " " " "	"	S 1 "	94.00	93.64		.36
" " " " "	"	S 3 "	93.80	93.66		.14
" " " " "	"	S 113 "	93.50	93.27		.23
" " " " "	"	S 115 "	93.50	93.36		.14
" " " " "	"	S 6 "	93.50	93.24		.26
" " " " "	"	S 8 "	93.40	93.22		.18

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Importer	Vessel	No. of Packages	Settlement Test	Official Test	Difference in favor of Revenue	Difference in favor of Merchant
Carter Hawley & Co.	Prince William V	600 Bags	95.75	96.30	.55	
" " " "	"	300 "	95.75	96.46	.71	
" " " "	"	60 "	87.40	87.83	.43	
J. M. Ceballos & Co.	Coya	639 "	97.10	97.78	.68	
" " " " "	"	300 "	97.10	97.40	.30	
Czarnikow	Prince	3900 "	96.98	97.05	.07	
Mac Dougall & Co.	William V					
Morewood & Co.	Pretoria	164 "	95.95	97 08	1.13	
" " "	"	176 "	89.95	90.88	.93	
Armstrong & Co.	Uller	1343 "	97.70	97.92	.22	
" " "	"	1850 "	97.60	98.15	.55	
" " "	"	3633 "	97.30	97.29		.01
" " "	"	200 "	96.30	98.12	1.82	
" " "	"	2126 "	96.00	97.98	1.98	
" " "	"	324 "	96.10	98.32	2.22	
Park Son & Co.	Madiana	143 "	95.05	95.22	.17	
G. O. Gordon	"	119 "	90.65	91.12	.47	
" " "	"	388 "	94.95	95.27	.32	
Park Son & Co.	Nora Wiggins	7200 "	85.90	86.52	.62	
Bartram Bros.	Madiana	45 Bbls	82.60	82.50		.10
Morewood & Co.	"	465 Bags	97.05	97.70	.65	
" " "	"	257 "	90.45	91.67	1.22	
B. H. Howell & Co.	Origen	200 Hhds	90.30	90.62	.32	
" " " " "	"	200 "	90.40	90.81	.41	
" " " " "	"	75 "	90.40	90.26		.14
" " " " "	"	2590 Bags	88.00	87.74		.26

Importer	Vessel	No. of Packages	Settlement Test	Official Test	Difference in favor of Revenue	Difference in favor of Merchant
I ...craft & Co.	Fontabelle	3 bbls	88.40	88.37		.03
" "	"	25 hhds	87.50	87.15		.35
" "	"	25 "	88.25	88.35	.10	
" "	"	45 bbls	86.55	86.22		.33
" "	"	63 hhds	84.25	83.22		1.03
" "	"	4 bbls	86.00	87.40	1.40	
" "	"	9 hhds	81.10	80.90		.20
" "	"	7 "	85.35	84.87		.48
" "	"	56 bbls	86.80	89.25	2.45	
" "	"	81 "	87.10	87.97	.87	
" "	"	79 "	86.40	87.87	1.47	
" "	"	3 hhds	87.90	88.10	.20	
" "	"	60 bbls	88.45	87.80		.65
" "	"	50 bags	90.60	91.25	.65	
" "	"	45 bbls	85.10	87.15	2.05	
" "	"	6 "	81.05	84.97	3.92	
" "	"	1 Trc.	88.25	86.27		1.98
" "	"	11 hhds	90.80	90.30		.50
" "	"	14 "	86.80	86.15		.65
Macy Dunham & Co.	Castle Eden	19 bbls	91.30	92.07	.77	
" " "	"	95 hhds	91.10	91.20	.10	
Walden, Benham & Co	Jason	275 bags	86.95	88.80	1.85	
" " "	"	70 "	85.15	84.70		.45
Leaycraft & Company.	Fontabelle	200 "	87.45	87.55	.10	

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REGULATIONS

GOVERNING THE

SAMPLING AND CLASSIFICATION

OF

IMPORTED SUGARS AND MOLASSES

UNDER THE

ACT OF JULY 24, 1897.

SAMPLING AND CLASSIFICATION OF IMPORTED SUGARS AND MOLASSES.

TREASURY DEPARTMENT,
OFFICE OF THE SECRETARY,
WASHINGTON, D. C., *October* 27, 1897.

To collectors and other officers of the customs:

The following regulations governing the sampling and classification of imported sugars and molasses under the provisions of the tariff act approved July 24, 1897, are prescribed for the guidance of customs officers.

L. J. GAGE, *Secretary.*

Regulations.

Sampling.

1. In the treatment of sugars under these regulations great care will be taken by samplers and other appraising officers to prevent the drying out of the samples. The covers shall be placed upon the tin sample boxes as soon as filled, the boxes thereafter to be placed in the wooden chests and the chests closed, locked and forwarded to the appraiser's office with as little delay as possible. The mixing and preparation of the general samples on the wharf and of the samples in the examination room and the laboratory shall be done with dispatch, and as far as practicable under conditions to prevent evaporation of moisture.

2. In regard to sugar in hogsheads, tierces, barrels and boxes, the packages of each mark shall be numbered from 1 upward as weighed, the numbers to be scored on the marked head of the packages and at the same time a double cross mark thus #, shall be scored just above and to the right of the number, to designate the "sample packages."

3. The packages so designated, unless sampled as weighed, shall be placed in tiers on the wharf, with a space 4 feet 6 inches
324 between them, the marked and numbered heads facing the said space, so as to be readily seen by the sampler.

4. The collector will be held solely responsible for the proper designation of sample packages as indicated, and will require the same to be placed on the wharf as herein provided, so that the work of sampling may be properly done. These duties will be performed under the supervision of the weigher and inspector in charge of the cargo. The weighing of permitted sugar, or sugar subject to be stored under general order, shall commence as soon as a sufficient number of packages have been discharged, to render it probable that the work will go on continuously until the cargo is completed.

5. The packages so designated for sampling will be indicated in the weigher's dock book by the letter "S" opposite the number of the package. In the case of resamples, as hereinafter provided, the letters "R. S." shall be so placed.

6. In regard to sugar in hogsheads, tierces, barrels and boxes, 25 per cent. of each mark shall be sampled; provided, that if the mark contain not more than thirty and more than ten packages 50 per cent. shall be sampled, and if it contain ten or less packages every package shall be sampled; and the collector shall endorse on the permit for the guidance of the discharging inspector, and also on the invoice, for the information of the appraiser, as follows: "Sample all packages." "Sample 25 % alternate even (or odd) numbers," "Sample 50 % even (or odd) numbers," as the case may be, the collector varying the order in his discretion in the last two cases, so as to prevent possible collusion.

7. The sample packages shall be selected in regular order as numbered, as for example, when 25 per cent. is to be sampled, Nos. 2, 6, 10, etc., or Nos. 1, 5, 9, etc., will be taken, according as the alternate even or odd numbers are designated on the permit. When 50 per cent. is to be sampled, Nos. 2, 4, 6, etc., or Nos. 1, 3, 5, etc., will be taken, according as the even or odd numbers are designated on the permit.

8. When a resampling of wooden packages is desired, a request for the same must be presented in writing within two official days after notice of the classification on the original samples has been sent to the importer, and in all cases of resampling of wooden packages every package not before sampled must be sampled. The merchant requesting such resample shall furnish the labor necessary to the placing of the packages in condition for sampling, as provided for sample packages in paragraph 3. When a resample is called for by the appraiser the weigher in charge of the district where the sugars are located shall place such packages in condition for sampling as provided for sample packages in the same paragraph.

9. All sugar in wooden packages shall be sampled by putting the trier directly through the center of the package from end to end, one regulation round tin box full to constitute a sample.

325 10. The samples as drawn shall be placed in tin boxes of uniform size furnished by the department, properly labeled as to number and mark for identification, and shall be conveyed to the appraiser's department in chests securely locked together with a letter of transmittal from the examiner in charge of the district as

per form furnished by this department. In cases where, owing to the presence of empty or broken packages, it is found impracticable to carry out the order of the collector on the permit, the fact shall be noted on the permit, and also in the examiner's letter of transmittal; and the examiner in charge of the district shall cause samples to be taken from representative packages selected by him so that the percentage required by the collector's order shall be secured.

11. Of sugar in baskets, 10 per cent. shall be sampled, and in bags and ceroons, 5 per cent., unless the mark contains 200 or less packages, when 25 per cent. shall be sampled; in mats, 2½ per cent. shall be sampled. The selection of the sample packages shall be made by the collector, as in the case of other sugars, when the cargo is weighed; every tenth basket, in the case of baskets; every twentieth draft in the case of bags and ceroons (unless the mark contain 200 or less packages, when every fourth draft shall be taken); and every fortieth draft, in the case of mats, shall be taken, care being observed to maintain the same number of packages to the draft throughout the entire cargo.

12. The packages so selected shall be steneiled in large characters "U. S. sample," in the presence of the weighing officer, when weighed. At places other than bonded warehouses or docks adjacent thereto, the sample packages, after being scored or steneiled, shall be taken by an officer, to be designated by the appraiser, who will be under the direct supervision of the examiner in charge of the district. Such officer shall see that the sample and resample packages are separated by marks and placed lengthwise in single or double tiers, with sufficient room and light for convenient and satisfactory sampling. He shall also keep tally of the number of sample drafts, and report to the examiner any violation of these regulations by the weighing officer. All such sugars shall be sampled as soon as they are weighed.

13. Sample and resample packages when placed in bonded warehouse shall be in the custody of the United States storekeeper, who shall see that they are separated by marks and placed lengthwise in single or double tiers, with sufficient light and room for convenient, satisfactory and safe sampling.

14. Sample and resample packages to be sampled on the dock shall be in the custody of the inspector in charge of the vessel or district, as the case may be, who shall see that they are separated by marks and placed lengthwise in single or double tiers, with sufficient room and light for convenient and satisfactory sampling.

15. In the case of bags and ceroons, except as noted in paragraph 35, the samples and resamples shall be taken from the mid-
326 dle of the package, a regulation round tin sample box full to constitute the sample, which shall be treated in all respects in the same manner as samples from hogsheads.

16. In the case of mat sugars, general samples shall be made up on the wharves and placed in the square tin boxes furnished by the department, each mark being kept separate, and the samples

shall be duly labeled and locked in the wooden chests provided for the purpose.

17. Merchant samplers are prohibited from boring or cutting into packages which have been set apart and marked for sampling and resampling, as herein provided, until the Government samples have been taken.

18. In the sampling of bags, ceroons and mats, the short trier will be used, care being exercised in all cases to take the sample fairly from the central contents of the packages, and in such manner that the samples in the case of mats shall be of a uniform quantity. When the hard condition of the sugar renders the use of the short trier impracticable, the knife may be used.

19. A larger percentage of any mark than hereinbefore provided shall be taken by direction of the examiner, at the time of taking either the original or the resample, when in his judgment such action is necessary to afford a fair representation of the mark. In such cases the additional packages to be taken shall be designated by the examiner and placed in condition for sampling by the weigher in charge of the district on which such sugars are located, upon requisition for such from the appraiser or his representative. Such samples shall be marked "extra samples," and shall be so designated in the examiner's letter of transmittal, and in determining the color or test of a mark, shall be treated as a part of the original or resample, as the case may be.

20. Sugars conveyed on lighters from the place of original discharge before samples have been taken shall not be removed therefrom until notice has been given by the inspector to the examiner in charge of the district of the time of their proposed removal.

21. The keys of the sample chests shall be in possession of the examiners in charge of districts, who, with the examiners at the appraiser's office, shall have sole custody of such keys.

22. At ports where a number of samplers are employed no one sampler should be continued on the same sugar district longer than one month; and a record of the assignment of examiners and samplers shall be kept by the appraiser.

23. When packages for original samples are selected, and in order to secure more correct and satisfactory results in case a resample is desired by either the importer or the appraiser, every alternate tenth basket, in the case of baskets, beginning with the fifth; every alternate fortieth draft, in the case of mats, beginning with the twentieth, and every alternate twentieth draft, in the case of bags and ceroons, beginning with the tenth (unless the mark contain 200 or less packages, when every alternate fourth draft, beginning with the second), shall be placed aside as before described for original samples, and marked in stencil "U. S. resample."

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24. At places other than bonded warehouses, and on docks where the sugars are to be weighed, sampled and lightered directly to another point, the resample packages shall be sampled at the same time as the sample packages, care being observed to keep such resamples separate and apart from the original samples. Such

samples shall be boxed, marked and labeled "resamples," and forwarded without delay to the appraiser's stores, where they shall be kept apart in a cool place until the expiration of the time hereinafter given the importer in which to call for a resample. Resample packages, when placed in bonded warehouses, shall not be sampled by the examiner in charge of the district unless he receive notice to do so from the appraiser's office.

25. Inspectors in charge of the vessel or district, as the case may be, shall have their permits indorsed by the examiner in charge of the district upon the completion of the cargo, stating thereon that the samples have been obtained in accordance with these regulations.

26. In cases where vessels discharge on one district and the sugars are lightered to another before sampling, the manifest, which accompanies the lighter and is delivered to the inspector in charge of the district where such sugars are to be weighed and sampled, shall be presented to the examiner for his indorsement, the same as the original permit. The inspector in charge of such district shall be held responsible for the treatment of all such sugars under these regulations, the same as if working under the original permit.

27. When sugars are discharged at places where the distance makes it impracticable for the regular conveyances to call for the samples, and where special provision is made by contract for other means of transportation, an official shall be detailed by the appraiser to take charge of such samples until they reach the appraiser's stores. When such transportation, owing to accident or storm, is interfered with, one of the experts may be detailed from the sugar room to go to such place, mix the different marks, and bring the samples of such marks to the appraiser's stores.

27. In the case of sugars which have gone through a process of refining, whether above or below No. 16 Dutch standard in color, general samples shall be made up on the wharves and placed in the tin sample boxes furnished by the department, each mark being kept separate. Inspectors in charge of the vessel or district, as the case may be, shall retain such sugars on the wharf until they are sampled and the permit is signed by the examiner in charge of the district. When necessary, the United States weigher shall place such packages as may be designated in condition for sampling, upon requisition of the examiner in charge of the district. When practicable, all refined sugars shall be sampled with a trier specially provided for that purpose, and such percentage shall be sampled
328 as in the judgment of the examiner will afford a fair representation of the mark. When there is doubt as to whether a sugar is raw or refined, the percentage of packages sampled and the mode of preserving the samples shall be the same as herein prescribed in the case of raw sugars.

29. It is important, in order to the successful operation of the triers, that they be kept clean and free from rust. Suitable cleaning and polishing materials will be duly supplied to the samplers, who are hereby instructed to take proper care of the implements. When sampling, and particularly when sampling gummy or sticky

sugars, the sampler shall frequently and thoroughly clean his trier, which must in each case be dried with a towel or drying cloth before further use. *All sugars must be drawn with dry triers.* Any failure to observe these requirements shall be reported at once to the appraiser by the examiner in charge of the district, and such failure shall be regarded as sufficient cause for removal.

30. Sugar closets on districts shall be substantially built and well secured by locks furnished by the department. All bonded warehouses in which sugars are stored shall be provided with such closets. The keys of the district closets shall be in possession of the examiner in charge of the district, who, with the examiner in charge of the sugar room at the appraiser's office and the sworn officers in charge of the conveyances, shall have sole custody of such keys.

31. In regard to melada and other sugar products not before mentioned, paying duty under the law by weight, the packages shall be numbered, scored, and placed by the collector the same in all respects as in the case of hogshead sugars, one package in every ten being designated for sampling. In order that correct samples may be taken, the heads of such sample packages shall be removed, and replaced by the collector's employees after the sampling has been completed.

32. The sampling shall be done under the personal supervision of an examiner, who shall take from each package placed on end and after removal of the head a fair representation of its contents, making up a general sample of each mark for transmission to the appraiser's office, as provided in the case of mat sugars.

33. In the case of molasses, at least one package in every ten in the order placed for gauging, or 10 per cent. of each mark throughout the cargo, will be taken, the examining officer at the same time making careful inspection of the whole cargo in order to satisfy himself whether the molasses is uniform in character or otherwise. If such inspection shall disclose any considerable variation in the quality of the packages of each mark a larger percentage shall be sampled as in the judgment of the examiner may be necessary in order to secure a fair representation of the mark. If any package or packages invoiced as molasses shall, in the judgment of the examiner, have the appearance of sirup or cane juice, a separate sample from each such package, properly labeled as to mark and character, shall be taken for examination, as hereinafter provided.

34. In drawing the samples care must be observed to
329 secure a fair representation of the contents of each package. General samples of the cargo shall be prepared by mixing thoroughly together the samples of each mark. From such several samples the cans provided by the department shall be filled, marked, and placed in the wooden chests, which must be duly locked and labeled, as in the case of sugars, for transmission to the appraiser's office.

35. Inasmuch as the absorption of sea water reduces the polariscopic test of sugar, there shall be no allowance on account of the increased weight of sugar importations due to unusual absorption of sea water or of moisture while on the voyage of importation, and

the provisions of article 851 of the customs regulations of 1892 shall not apply to sugar importations. That portion of each mark that has absorbed sea water or moisture on the voyage of importation shall be segregated and sampled, tested, and classified separately. Care must be taken that such sugars are sampled so as to fully represent the contents of the packages.

36. All sugars discharged under night permits shall remain on the dock until released by the examiner in charge of the district. The United States sample packages of such sugars, after being scored or stenciled, shall be in the custody of the inspector in charge of the vessel or the district, as the case may be, who shall see that they are separated by marks, and placed lengthwise in single or double tiers with sufficient room and light for convenient and satisfactory sampling.

37. All officers of the customs having duties in connection with the treatment for duty of imported sugars are expected to co-operate and to use the utmost care and circumspection in order to the proper selection, marking, and placing of the sample packages, so that the work of sampling and classification may be facilitated. The examiners shall be held responsible by the appraiser for the strict and impartial enforcement of these regulations, and to this end they shall be notified relative to the time of discharge and weighing of sugar cargoes on their respective district by the inspector and weigher in charge of the same.

38. Section 2882 of the Revised Statutes provides that imported sugars which shall be removed from the wharf or place where put without the consent of the proper officer and before the quality has been ascertained shall be forfeited, and may be seized by any officer of the customs or inspection.

39. In pursuance of the authority therein contained, it is directed that the packages designated and placed for sampling under these regulations shall not be removed from Government custody without the written consent of the examiner in charge of the district, which may be given as soon as the samples have been taken, provided in his judgment there shall be no reason for holding them further. Suitable forms for this purpose will be furnished by the department on application duly made. Sugar removed without such
330 consent may be seized and proceedings taken for forfeiture, as required by the section of the law named.

40. The appraiser shall notify the collector of the boundaries of the sugar districts and the location of the examiner's office on each district, and such information will be furnished by the collector to the inspectors and weighing officers. The collector shall furnish each inspector, weigher and storekeeper with a copy of these regulations.

41. In order to the prompt execution of the foregoing instructions, appraisers will keep the department advised relative to the best means of securing speedy communication with the examining officers on the wharves, and the necessary measures will be taken for the frequent and expeditious transmission of samples from the wharves to the appraiser's stores.

Classification.

42. When the samples have reached the classification room in the appraiser's office they shall be separated by marks, and the samples representing each mark shall be carefully examined with reference to their color by the Dutch standard. Should such samples, or any of them, be found to be close to No. 16 Dutch standard in color, they shall be examined and passed upon by two experts in the appraiser's office, and in case of disagreement between them as to their degree of color, severally, according to the Dutch standard, the appraiser, or some person designated by him, shall decide between them.

43. Raw sugars represented by samples found to be above No. 16 Dutch standard in color, and all sugars which have passed through a process of refining, shall be so classified with respect to color or kind, and rate of duty. The quantity of raw sugar so classified of each mark shall be based on the proportion of the mark which the samples so classified represent. In case of a resample of raw sugar, the quantity of sugar of each mark classified for duty, above No. 16 Dutch standard in color, shall be based on the proportion of the mark which *all* the samples so classified represent when compared with the total of the samples of such mark drawn and examined. When there is a doubt as to whether a given sugar is raw, or has passed through a process of refining, a sample of such sugar shall be submitted to the laboratory for expert examination, and the report of the chemist, with his expressed opinion, shall be given due weight in determining the classification of the sugar for the assessment of duty.

44. Samples of the sugar so classified shall be preserved and sealed in glass bottles, labeled with the name of the importer, date of importation, place whence imported, name of vessel, classification, mark, number and character of packages, and the names of the examiners who passed the same. The bottles containing such samples shall be sent by the appraiser to the collector at the time the invoice is returned, and shall be publicly exhibited at the custom house for at least one week thereafter.

331 45. Raw or unrefined sugars not above No. 16 Dutch standard in color shall be separated by the experts in the examining room, according to marks, and the samples of each mark must be thoroughly mixed together, and reduced, if necessary, by quartering, until the proper amount is secured for the general sample. From such general sample two round tin sample boxes of uniform size, made to contain not less than one pound each, shall be closely packed full of sugar and transmitted forthwith to the laboratory for polariscopic test. The boxes must be so made as to be practically air-tight when closed. The samples of a mark first sent to the laboratory shall be known as "first samples," and shall be so entered in the record of tests as hereinafter provided.

46. In transmitting the samples from the examiner's room to the laboratory, they shall be indicated only by serial numbers, the key of which shall be kept in a permanent form in the examiner's room

in the record hereinbefore mentioned; and the laboratory officers shall not be informed in any manner as to the identity of such samples.

47. In conformity with the principles of commercial usage, and in order to secure correct results in the testing of sugars for the assessment of duty, it is directed that at least two tests shall be made of each sample of sugar sent to the laboratory, and of its several products as specified in the law, except molasses polarizing more than two degrees above or below forty degrees or fifty-six degrees, and the test which shall be accepted for the classification of a mark shall be an average of tests as hereinafter provided, such averages to be carried to five places of decimals when called for by the figures.

48. Samples sent to the laboratory, in manner as provided in paragraphs 45 and 46, shall be carefully mixed. Sugars containing hard lumps, not readily crushed and mixed by hand, must be mixed in a mortar or by other adequate means. After thoroughly mixing, the respective samples shall be divided into two equal portions, each of which shall be tested by different experts. Should the results of the two separate tests of a sample so made correspond within three-tenths of one degree, the average of the two shall be accepted as the test of such sample.

49. Should the results not correspond within three-tenths of one degree, a third test of the sample, after remixture of the two portions, shall be made by a third expert, when practicable, and of the three tests so made the average of the two most closely corresponding shall be accepted as the test of the sample, provided the two last-mentioned tests correspond within three-tenths of one degree; and provided further, that if one of the three tests so made be the average of the other two tests, and correspond with the same within three-tenths of one degree, then such test shall be accepted as the test of the sample.

50. When two of the three tests so made do not correspond within three-tenths of one degree a fourth test of the sample shall be
332 made, which shall be subject to the same provisions as herein prescribed with reference to the preceding tests; but discrepancies rendering such fourth test necessary should not occur.

51. The tests of the two samples of a mark first sent to the laboratory having been duly reported, shall be permanently entered in the record of tests, according to their serial numbers, respectively, together with the accepted test of each sample, determined in manner as hereinbefore provided. Should such accepted tests correspond within five-tenths of one degree, the average of the two shall be taken as the true test of the sugar.

52. Should the accepted tests of the first samples not correspond within five-tenths of one degree, a third sample of the mark to be known as the "reserved sample," shall be made up from the reserved portion of the mark, hereinafter provided for, in manner as prescribed for first samples, labeled with the regular serial number, and recorded; and in testing the reserved sample the rules herein prescribed for testing first samples shall be strictly observed.

53. The tests of the reserved sample having been duly reported

and recorded, as provided for first samples, the accepted tests of the three samples of the mark shall be considered together. Of the three separate tests of the mark so recorded, the average of the two most closely corresponding shall be taken as the test of the sugar; but if one of the said tests be the average of the other two, it shall be taken as the correct test.

54. In order to provide for the "reserved sample" before mentioned, and for the preservation of a portion of the mark in condition as imported, it is directed that when the "first samples" are prepared and sent to the laboratory a portion of each mark so taken as to fairly represent the entire general sample shall be reserved, three-pound glass jars provided with ground stoppers to be used for the purpose. In all cases the jars must be firmly packed full of sugar before closing, and sealed so as to make the same air-tight. Such sugars, after being properly labeled for identification, shall be marked "Reserved," and shall be held in safe custody in the examiner's room for use when required.

55. When the test of the original sample has been determined, in manner as provided in paragraphs 45 to 53, both inclusive, the appraiser shall immediately notify the importer, by messenger whenever practicable, of such test. Should the importer, within two official days after such notice has been sent to him by the appraiser, claim an error in the test so reported, and request a resample of any mark or marks, such resample may be granted, provided, on evidence furnished, such claim shall appear to the appraiser to be well founded.

56. When resamples are submitted for test they shall be labeled with the regular serial numbers and treated in all respects in the same manner as original samples. Portions of the resamples of each mark shall be reserved and properly labeled for identification
333 as such, to be used when required, as provided for the several portions of the original samples.

57. In cases of resample the test upon which the sugar shall be classified for duty shall be the average of the test of the original and the resample, on the basis of the proportion of the mark represented by each, but should conclusive evidence be furnished to the appraiser, showing that such average is erroneous, it shall be competent for him to consider such evidence, and to classify the mark upon the test of the original or the resample, as may seem to him most just. In such cases all the facts shall be reported at once to the department.

58. It will be understood that in all cases where a manifest error has been made, as, for example, by the accidental substitution of samples or transposition of serial numbers, such error must be corrected. The reserved portion of a mark may be resorted to by the appraiser at any time, before he has made his return on the invoice, for the purpose of determining and correcting such error.

59. When practicable the samples of each mark shall be sent to the appraisers' stores and tested daily as drawn, and the testing of each lot so sent in shall be conducted in all respects as herein prescribed for that of an entire mark. In such cases the test of the

mark shall be the average of the ascertained tests of the several lots so found, based on the proportion of the mark which each of the said lots represents. In sending notice of test to the importer, as provided in paragraph 55, the appraiser shall furnish, in addition to the average test of the mark, the quantity and test of each lot from which such average test is obtained. In the preparation and treatment of reserved samples the same principles will hold as with that of an entire mark.

60. In the classification of molasses, when the result of the first test is within two of forty degrees, or of fifty-six degrees, as the case may be, either above or below, the foregoing directions regarding the duplicate or triplicate tests of sugars shall be followed. Importations invoiced and entered as molasses, possessing in any degree the taste or smell or other characteristic of sirup of cane juice, shall be subjected to chemical analysis, and determinations will be made of the percentage of water and of the cane sugar in the dry substance. For the determination of moisture in molasses, syrups, and *masse cuites*, dry from 1 to 2 grams in a flat dish of not less than 7 centimeters diameter at the temperature of boiling water for two hours. Care must be taken to run the liquid in a film over the bottom of the dish and to retain in a horizontal position during the entire operation.

61. In the event of the polarization of the dry substance being above 75 per cent., the sample shall be held to be sirup of cane juice, within the meaning of the tariff; but should the polarization of the dry substance not exceed 75 per cent., the sample shall be designated as molasses, unless there be other evidence of a conclu-
334 sive character to warrant its designation as sirup of cane juice.

62. It may here be stated as the view of the department that molasses within the meaning of the tariff is the liquid residuum drained or purged from sugar, and hence is the result of a process of manufacture which has for its object the formation of sugar; while, on the other hand, sirup of cane juice is the juice of the cane highly concentrated, but not to the point of crystallization, and hence is the result of a process of manufacture having for its chief object the concentration of the juice to the point of preservation, but short of crystallization.

63. A permanent record of the classification of sugars and molasses imported into the United States, subject to duty under the law, shall be kept in the examiner's room in the appraisers' office, which shall be known as the "Record of tests." In this book shall be recorded all marks of sugar received in the examiner's room, in the order in which they are examined, with their color according to the Dutch standard, and all samples of sugar representing the same, severally, by their serial numbers, in the order in which they are sent to the laboratory, together with the tests of the same, respectively, as reported from the laboratory. Said record shall show further the nature of the samples, whether "original" or "resamples," and whether "first" or "reserved" samples.

64. A permanent record shall also be kept in the laboratory of all

samples received from the examiner's room, which shall be entered therein by their serial numbers in the order in which they are received; and the officer in charge of the laboratory shall report all tests made and recorded of such samples, severally, including the third and fourth tests when made, to the examiner in charge of classifications, who shall enter such report in the Record of tests, and shall determine and record the accepted test of the mark, in manner as hereinbefore provided.

65. When an invoice of sugar or molasses has been passed, the appraiser shall at once send, by messenger whenever practicable, a written notice to the importer informing him of the classification and test of his importations. On the morning of the first official day after the return of invoices to the collector covering importations of sugar or molasses, a tabulated statement of all such invoices showing particulars of importation, the color by the Dutch standard, and the ascertained polariscopic test of each mark, as per form hereto annexed, shall be conspicuously posted at the custom-house for the information of the trade. Duplicate statements shall at the same time be prepared and forwarded for exchange between the ports of Boston, New York, Philadelphia, Baltimore, New Orleans, and San Francisco, which, when received, shall also be conspicuously posted, as herein provided, for trade information.

66. As a means of determining relative to uniformity of results in the testing of imported sugars at the several ports, it is directed that on each alternate day, beginning with Monday, a sample of
335 sugar shall be tested at each of the ports of Boston, New York, and Philadelphia, and at the same time duplicate samples of the same sugar shall be exchanged for test between the appraisers of the said ports. The duplicates shall be sent in the tin box prescribed in paragraph 45, which must be firmly packed full of sugar and sealed air-tight. The samples shall be numbered at each port of importation from 1 upward, and the duplicates shall be marked for identification with the same number, the name of the importing port, and the date of test at such port.

67. Test of the duplicate samples must be made as soon as they have been received. The duplicates shall be sent to the laboratory under regular serial numbers, the identifying marks having been removed, after having been first entered in a special record, together with their respective serial numbers. Samples at the port of importation and those sent for exchange shall be tested in all respects as provided in paragraphs 48 to 50, both inclusive, and the separate tests of such samples, together with the accepted tests, shall be promptly reported from each port to the department, under their respective identifying marks.

68. On each alternate day, beginning with Tuesday, a sample of sugar shall be tested in the dry substance at each of the ports named in paragraph 66, and duplicate samples of the same sugar shall at the same time be exchanged for like test between the appraisers of the said ports. The duplicates shall be prepared, marked for identification, and forwarded in manner as provided in paragraph 66. Such samples shall be sent to the laboratory as soon as received,

under their respective identifying marks, and reports of tests shall be promptly forwarded from each port to the department under such marks. Such reports shall show the direct polarization, the percentage of moisture, and the test in the dry substance. When sugars are imported and tested at any port other than those named in paragraph 66, samples shall be tested in the dry substance at the port of importation, and duplicate samples shall be transmitted for like test to each of the said ports. The samples shall be prepared and reports of said tests shall be made in all respects as herein prescribed for samples exchanged and tested at the said first-named ports. Reports of tests prescribed in this and the preceding paragraph shall be made on forms provided by the department, which will be duly furnished on requisition.

69. In addition to the foregoing, the appraiser at any sugar importing port is hereby authorized, when in his judgment it shall be desirable, to call for a sample or samples of the reserved portions of any mark which he may select from the exchange sheets provided for in paragraph 65, for the purpose of obtaining the polariscopic test of the same at this port. Each sample shall be prepared at the port of transmittal in manner as provided in paragraph 66, and shall be labeled with the name of the importer, the date of test, the invoice mark as reported on the exchange sheet, the separate tests, and the accepted test. Such samples may be sent to the labo-
336 ratory under their identifying marks or under serial numbers, as the appraiser may deem advisable. Tests of all samples shall be made and the accepted test determined in manner as prescribed in paragraphs 48 to 50, both inclusive. Should there be any material difference between the test, as determined at the port of importation and the one so found, the appraiser shall take the necessary means to verify the correctness of his results, and shall in all cases forward promptly a report of such tests, with such comments as he may deem necessary, for the information of the department.

70. Paragraph 212 of the tariff act provides in part that sugars after being refined, when tinctured, colored, or in any way adulterated, shall pay special rates of duty. In view of this provision appraising officers will cause all refined sugars to be subjected to expert examination, and will report to the collector whether the *the* same, after being refined, have been tinctured, colored, or in any way adulterated. At ports where the Government has no facilities for making such expert examination, samples of all refined sugars imported shall be forwarded to the appraiser at New York, who will cause the necessary expert examination to be made and report the result to the collector at the port of importation.

71. Sugars which are subject to the additional duty imposed under the provisions of section 5 of the tariff act because of any bounty or grant paid or bestowed on the exportation of the same from the country of production, and the amount of such bounty or grant is made dependent on the polariscopic test of the sugar, must be subjected to such test, and report thereof will be made to the collector on the invoice, for use in liquidation; but all hard refined sugars, such as cut loaf, crystals, crushed or granulated, shall be

deemed to have tested at least 99.5° when exported from the country of production. In all cases where the classification of imported sugar for the assessment of duty is liable to be contested, either on the question of its polar-scopic test or on one arising under the provision of law referred to in the preceding paragraph, representative samples of such sugars shall be preserved in manner as provided in paragraph 54, and such samples shall be held for use until the final liquidation of the entry.

72. All samples of sugar sent to the laboratory for test must be preserved as nearly as possible in the same condition as when received, and shall be returned therefrom to the examining room, in such condition, with the reports of the tests. All samples tested for exchange, and all exchange samples, as soon as they have been returned from the laboratory, shall be labeled with their identifying mark, securely sealed air-tight, and held in safe custody in the examining room sixty days from the date of test, for such further test or investigation as may be ordered by the department. In case any exchange sample has been received at any port not properly filled and sealed as herein prescribed, the appraiser at the port of receipt shall immediately notify the appraiser at the port of transmittal, and shall also report the facts to the department.

337 73. Attention is hereby particularly called to the provision of article 840, customs regulations of 1892, prohibiting the admission of all persons to the examining rooms of the appraiser's office, except officers and employees whose duties require them to have access thereto. This provision must be strictly enforced.

74. All requests for the resampling of any mark or marks of sugar shall be properly filed, and a record thereof shall be kept by the examiner in charge of classifications.

75. These regulations shall take the place of all orders or regulations heretofore issued with reference to the sampling and classification of imported sugars and molasses.

76. The following is the form of statement which will be used as provided in paragraph 65, blanks for which will be furnished by the department on requisition.

Daily Statement of Classification of Sugar, etc.

U. S. APPRAISERS' OFFICE, ——, ——, 189–.

Name of importer.	Name of vessel.	Where from.	Date of entry.	Date of shipment.	Marks and plantations.	Number and kind of packages.	Kind of sugar.	Color by the Dutch standard.	Polariscopic test.	Rate of duty per pound.	Countervailing duty.	Remarks.

Standardization and adjustment of apparatus and instruments.

77. All polariscopes, weights, flasks, polariscope tubes and quartz control plates used in the work of testing sugar by the polariscope will be standardized, and their accuracy tested, by the office of standard weights and measures, United States Coast and Geodetic Survey. They will be marked with the initials U. S. C. R., and no tests of sugar will be made with apparatus which is not so marked, unless special authority is given. Each quartz control plate will be accompanied by a table giving its sugar value at temperatures of each degree centigrade from 10° to 35°, in terms of the Ventzke scale.

338 Proper arrangement of laboratories.

78. Plans for laboratories for the testing of sugar must be approved by the Secretary of the Treasury.

The room used for the purpose shall be one that is as far removed as possible from the vibration of machinery; it must be well lighted and have some means of artificial heating, so that the temperature may be controlled, and shall not be too near steam boilers, furnaces, flues, or any source of heat which cannot be controlled. The polariscope shall be placed in the darkest part of the room, and this part of the room may be darkened, if desired, by curtains or hangings. In no case, however, shall the polariscope be entirely separated from

the room in which the rest of the work is performed, as the solutions must be made up and polarized at the same temperature. The lamp used for the illumination of the polariscope, on the other hand, must be separated from the instrument, as its heat tends to increase the temperature of the room and cause it to vary from time to time. The separation of the lamp from the instrument will be best accomplished by means of a board partition, making a separate compartment for the lamp, which may have its own window or opening for ventilation. The partition must be perforated with an opening just large enough for the passage of light to the instrument. If a separate compartment for the lamp can not be made, a wooden screen may be used, perforated in a proper manner, and placed on the table between the instrument and the lamp.

The table on which the polariscope stands must be level, and the instrument itself must not be near any source of uncontrolled heat, and must not be exposed to the direct rays of the sun.

Instructions Relative to the Use of the Polariscope.

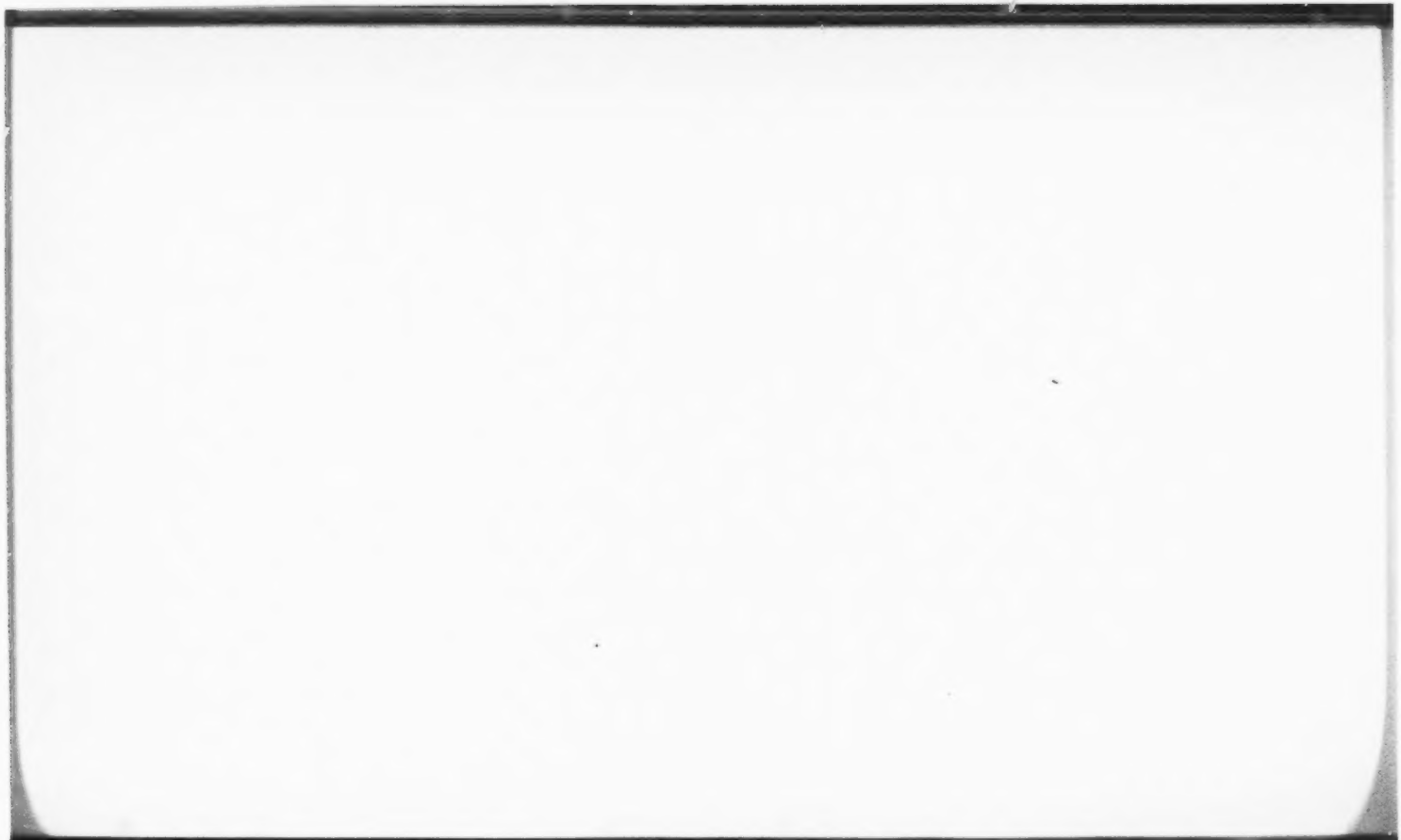
Definition of the word "degree" as it occurs in the act.

79. The expression "testing * * * *degrees* by the polariscope," occurring in the act, is construed to mean the *percentage* of pure sucrose contained in the sugar, as ascertained by polarimetric estimation. Until further notice the degree of the "Ventzke scale," as hereinafter defined, will be considered as indicating the correct percentage of sucrose, in the form of instrument used by this department in testing sugar. The "Ventzke scale" is hereby defined to be such that *one degree of the scale is the one-hundredth part of the rotation produced in the plane of polarization of white light in a column* 200 *millimeters long, by a standard solution of chemically pure sucrose at* 17.5° *C.; the standard solution of sucrose in distilled water being such as to contain, at* 17.5° *C. in* 100 *cubic centimeters,* 26.048 *grams of sucrose.* The density of this solution will be 1.10 at the given temperature.

In this definition the weights and volumes are to be considered as *absolute*, all weighings being referred to a vacuum.

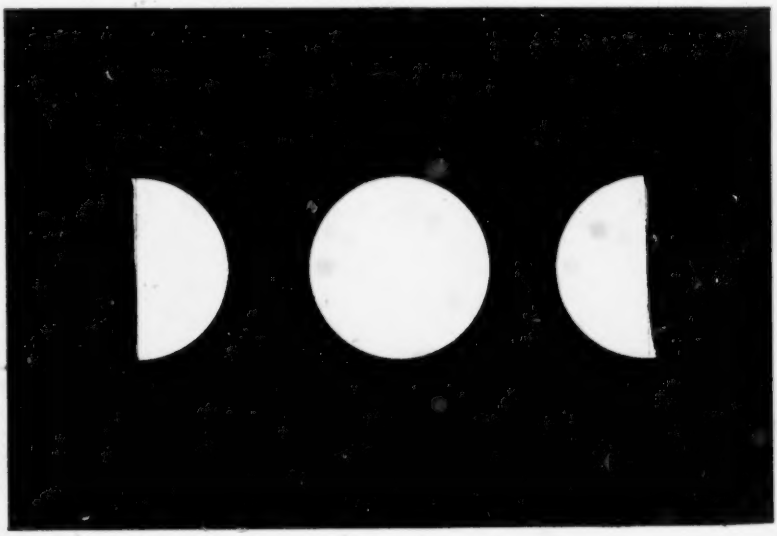
339 Directions for the polarization of sugar.

80. The following directions for the use of the polariscope in testing sugar are based upon the recommendations in a report made by a commission consisting of the chief chemist of the Department of Agriculture, the chemist of internal revenue, and the assistant in charge of the office of standard weights and measures, Coast and Geodetic Survey, and must be closely adhered to in all tests of sugar for classification.



482 ½

Fig. 2.



Description of instrument and manner of using.

The instrument to be employed in the testing of imported sugars for the assessment of duty is known as the half shadow apparatus of Schmidt and Haensch. It is shown in the following cut:

Fig. 1.

The tube N contains the illuminating system of lenses and is placed next to the lamp; the polarizing prism is at O, and the analyzing prism at H. The quartz wedge compensating system is contained in the portions of the tube marked F, E, G, and is controlled by the milled head M. The tube J carries a small telescope, through which the field of the instrument is viewed, and just above is the reading tube K, which is provided with a mirror and magnifying lens for reading the scale.

The tube containing the sugar solution is shown in position in the trough between the two ends of the instrument. In using the instrument the lamp is placed at a distance of at least 200 millimeters from the polarizing end; the observer seats himself
340 at the opposite end in such a manner as to bring his eye in line with the tube J. The telescope is moved in or out until the proper focus is secured to give a clearly defined image, when the field of the instrument will appear as a round, luminous disk, divided into halves by a vertical line passing through its center, and darker on one half of the disk than on the other, when the compensating quartz wedge is displaced from the neutral position. If the observer, still looking through the telescope, will now grasp the milled head M and rotate it first one way and then the other, he will find that the appearance of the field changes, and at a certain point the dark half becomes light and the light half dark. By rotating the milled head delicately backward and forward over this point he will be able to find the exact position of the quartz wedge operated by it, in which the field is neutral, or of the same intensity of light on both halves. The three different appearances presented by the field are best shown in Fig. 2.

With the milled head set at the point which gives the appearance of the middle disk as shown above, the eye of the observer is raised to the reading tube K, which is adjusted to secure a plain reading of the divisions and the position of the scale is noted. It will be seen that the scale proper is attached to the quartz wedge which is moved by the milled head; and attached to the other quartz wedge is a small scale called a *vernier*, which is fixed, and which serves for the exact determination of the position of the movable scale with reference to it. On each side of the zero line of the vernier a space corresponding to *nine* divisions of the movable scale is divided into *ten* equal parts. By this device the fractional part of a degree indicated by the position of the zero line is ascertained in tenths; it is only necessary to count from zero, until a line is found which makes a continuous line with one on a movable scale.

With the neutral field, as indicated above, the zero of the movable scale should correspond closely with the zero of the vernier, unless the zero point is out of adjustment.

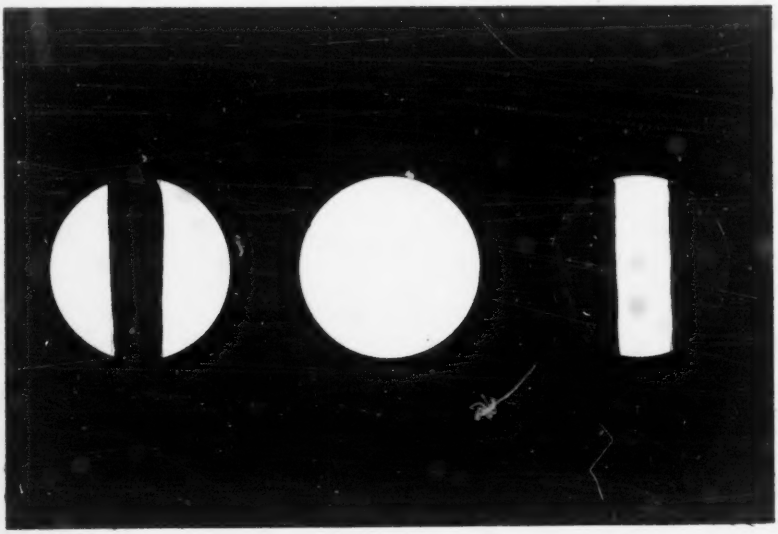
81. If the observer desires to secure an *exact* adjustment of the zero of the scale, or in any case if the latter deviates more than one-half of a degree, the zero lines are made to coincide by moving the milled head and securing a neutral field at this point by means of the small key which comes with the instrument, and which fits a small nipple on the *left*-hand side of F, the fixed quartz wedge of the compensating system. This nipple must not be confounded with a similar nipple on the *right*-hand side of the analyzing prism H, which fits as well, but which *must never be touched*, as the adjustment of the instrument would be seriously disturbed by moving it. With the key on the proper nipple it is turned one way or the other until the field is neutral. Unless the deviation of the zero be greater than 0.5 degree it will not be necessary to use the key,
342 but only to note the amount of the deviation, and for this purpose the observer must not be content with a single setting, but must perform the operation five or six times and take the mean of these different readings. If one or more of the readings show a deviation of more than 0.2 degree from the general average they should be rejected as incorrect. Between each observation the eye should be allowed a moment of rest.

The "setting" of the zero having been performed as above, the determination of the accurate adjustment of the instrument by means of the "control" quartz plates is proceeded with. One or more such plates will be furnished with each polariscope and as their sugar values vary with changes of temperature, each plate will be accompanied by a table giving its exact value at different temperatures from 10° to 35° C.

82. The plate is placed in the instrument and the field observed; it will be seen that the uniform appearance of the field is changed. The milled head is turned to the right until the exact point of neutrality is re-established, just as described above in setting the zero. The scale is read, the observation repeated, the reading taken again, and so on until five or six readings have been made. The average is taken, readings being rejected which show a divergence

486½

Fig. 3.



of more than 0.2, and the result corrected for the deviation of the zero point, if any was found, the deviation being added if it was to the left and subtracted if to the right. If the adjustment of the instrument be correct the result should be the value of the control plate used, as ascertained from the table, for the temperature of 20° C. A variation of 0.2 from the established values may be allowed for errors of observation, temperature, etc., but in the hands of a careful observer *a deviation greater than this after a careful setting of the zero shows that the instrument is not accurately adjusted.*

After the adjustment of the instrument the setting of the zero point is dispensed with, the indication of the scale for sugar solutions being corrected by the amount of deviation shown in the reading of the control plate from its established value as ascertained from the table, at the temperature of the room.

For example: A sugar solution polarizes 80.5; the control plate just before had given a polarization of 91.4, the temperature of the room during both observations being 25° C. According to the table the value of the control plate at 25° C. is 91.7; the reading is therefore 0.3 too low, and 0.3 is added to the reading of the sugar solution, making the corrected result 80.8. The temperature of the room must be ascertained from a standardized thermometer placed close to the instrument and in such a position as to be subject to the same conditions.

83. The use of the new apparatus of Schmidt and Haensch, known as the triple-shadow polariscope, is also permitted
343 and recommended. The accompanying diagram (Fig. 3) shows the appearance of the field of this instrument in the three positions of the quartz wedge:

Preparation of the sugar solution for polarization.

84. If the sample is not entirely uniform it must be thoroughly mixed before weighing, after all the lumps are broken up, best with a mortar and pestle. Then 26.048 grams are weighed on the balance in the tared German-silver dish furnished for this purpose. Care must be taken that the operations for mixing and weighing are not unduly prolonged, otherwise the sample may easily suffer considerable loss of moisture, especially in a warm room. The weighed portion of sugar is washed by means of a jet from a wash bottle into a 100 cubic-centimeter flask, the dish being well rinsed three or four times and the rinsings added to the contents of the flask. The water used must be either distilled water or clear water which has been found to have no optical activity. After the dish has been thoroughly rinsed, enough water is added to bring the contents of the flask to about 80 cubic centimeters, and it is gently rotated until all the sugar has dissolved. The flask should be held by the neck with the thumb and finger, and the bulb not handled during this operation. Care must be taken that no particle of the sugar or solution is lost. To determine if all the sugar is dissolved, the flask is held above the level of the eye, in which position any undissolved crystals can be easily seen at the bottom. The character of the solution is now observed. If it be colorless or of a very light straw color, and not opalescent, so that it will give a clear, transparent

liquid on filtration through paper, the volume is made up directly with water to the 100 cubic-centimeter mark on the flask. Most sugar solutions, however, will require the addition of a clarifying or decolorizing agent in order to render them sufficiently clear and colorless to polarize. In such case, before making up to the mark, a solution of subacetate of lead is added.*

The quantity of this agent required will vary according to the quality of the sugar. From 20 to 60 drops (1 to 3 cubic centimeters) will answer for most sugars; for molasses more may be required.

85. After adding the solution of subacetate of lead the flask must be gently shaken, so as to mix it with the sugar solution. If the proper amount has been added, the precipitate will usually subside rapidly; but if not the operator may judge of the completeness of the precipitation by holding the flask above the level of the eye and allowing an additional drop of subacetate of lead to flow down the side of the flask into the solution. If this drop
345 leaves a clear track along the glass through the solution it indicates that the precipitation is complete. If, on the other hand, all trace of the drop is lost on entering the solution, it indicates that an additional small quantity of the subacetate of lead is required. The operator must learn by experience the point where the addition should cease; *a decided excess of subacetate of lead solution should never be used.*

The use of subacetate of lead should, in all cases, be followed by the addition of "alumina cream"† in about double the volume of the subacetate solution used, for the purpose of completing the clarification, precipitating excess of lead, and facilitating filtration. In many cases of high grade sugars, especially beet sugars, the use of alumina cream alone may be sufficient for clarification without the previous addition of subacetate of lead.

The solution is now made up to the mark by the addition of distilled water in the following manner: The flask, grasped by the neck between the thumb and finger, is held before the operator in an upright position, so that the mark is at the level of the eye, and water is added, drop by drop, from a siphon bottle or wash bottle, until the lowest point of the curve or meniscus formed by the surface of the liquid just touches the mark. If bubbles hinder the operation, they must be broken up by adding a single drop of ether, or a spray from an ether atomizer, before making up to the mark. The mouth of the flask is tightly closed with the thumb and the

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* Prepared as follows: Boil an aqueous solution of lead acetate with an excess of lead oxide (PbO) for half an hour, and make filtered solution of a concentration of about 1.25 specific gravity. Solid subacetate of lead may be substituted for the normal salt and oxide in the preparation of the solution.

† Prepared as follows: Shake powdered commercial alum with water at ordinary temperature until a saturated solution is obtained. Set aside a little of the solution, and to the residue add ammonia, little by little, stirring between additions, until the mixture is alkaline to litmus paper. Then drop in additions of the portions left aside, until the mixture is just acid to litmus paper. By this procedure a cream of aluminium hydroxide is obtained suspended in a solution of ammonium sulphate, the presence of which is not at all detrimental for sugar work when added after subacetate of lead, the ammonium sulphate precipitating whatever excess of lead may be present.

contents of the flask are thoroughly mixed by turning and shaking. The entire solution is poured upon the filter, using for this purpose a funnel large enough to contain all the 100 cubic centimeters at once, and a watch glass is placed over the funnel during filtration to prevent a concentration of the solution by evaporation.

The funnel and the vessel used to receive the filtrate must be perfectly dry. The first portion of the filtrate, about 20 to 30 centimeters, should be rejected entirely, as its concentration may be affected by a previous hygroscopic moisture content of the filter paper. It may be necessary to return subsequent portions to the filter until the liquid passes through perfectly clear.

If a satisfactory clarification has not been obtained, the entire operation must be repeated, since *only with solutions that are entirely clear and bright can accurate polarimetric observations be made.*

86. If the solution be still too dark to polarize, even in the
346 100 millimeter tube, as in the case of dark-colored molasses, it may be decolorized by means of bone black. The use of this clarifying agent should be avoided if possible, however, on account of its well-known property of absorbing sugar. If its use is found absolutely necessary, a fresh solution is prepared, and before filtration four or five grams of dry bone black are placed in the apex of the filter paper. The first 50 or 60 cubic centimeters of the filtrate must be rejected.

When a sufficient quantity of the clear liquid has passed through the filter, the 200 millimeter observation tube is filled with it. The 100 millimeter tube should never be used except in the rare cases, when, notwithstanding all the means used to effect the proper decolorization of the solution, it is still too dark to polarize in the 200 millimeter tube. In such cases the shorter tube may be used, and its reading multiplied by two, but the zero deviation must then be determined and applied to the product. This will give the reading which would have been obtained if a 200 millimeter tube could have been used, and it only remains to apply the correction determined by the use of the control plate as previously described.

Example:

Solution reads in 100 millimeter tube	47.0
Multiplied by 2	2.0
Product	94.0
Zero reads plus 0.3	0.3
Solution would read in 200 millimeter tube	93.7
Reading of control plate	90.4
Sugar value of control plate	90.5
Instrument too low by	0.1
Add 0.1 to	93.7
Correct polarization of solution	93.8

Before filling the tube it must either be thoroughly washed and dried or rinsed several times with a portion of the solution itself. The cover glasses must also be clean and dry and without serious defects or scratches. Unnecessary warming of the tube by the hands during the filling should be avoided. It is closed at one end with the screw cap and cover glass and grasped by the other end with the thumb and finger. The solution is poured in until its curved surface projects slightly above the opening, the air bubbles allowed time to rise, and the cover glass pushed horizontally over the end of the tube in such a manner that the excess liquid is
347 carried over the side, leaving the cover glass exactly closing the tube with no air bubbles beneath it, and with no portion of the liquid upon its upper surface. If this result is not attained the operation must be repeated, the cover glass being rubbed clean and dry, and the solution again brought up over the end by adding a few more drops. The cover glass being in position, the tube is closed by screwing on the cap. The greatest care must be observed in screwing down the caps that they do not press too lightly upon the cover glasses. By such pressure the glasses themselves may become optically active and cause erroneous readings when placed in the instrument. It must therefore be ascertained that the rubber washers are in position over the cover glasses, and the caps should be screwed on lightly. It must also be remembered that a cover glass, once compressed, may part with its acquired optical activity very slowly, and some time must be allowed to elapse before it is used again.

87. The polariscopic reading may now be taken, an observation on the control plate having been made immediately before, as previously described. Then, *without altering the position of the instrument relative to the light, or changing the character of the latter in any way*, the tube filled with the sugar solution is substituted for the control plate. The telescope is adjusted, if necessary, so as to give a sharply-defined field, which must appear round and clear. This condition *must be fulfilled* before the observation is performed, as it is essential to accuracy. The milled head is turned until the neutral point is found, and the reading is taken exactly as previously described, the operation repeated five or six times, the average taken with the rejection of aberrant readings, the average figure corrected for the deviation shown by the control observation from the sugar value of the control plate at the temperature of observation as given in the table, and the result taken as the polarization of the sugar. When a series of successive polarizations is made under the same conditions as regards temperature, position of the instrument with relation to the light, intensity of the light, etc., the control observation need not be made before each polarization, one such observation being sufficient for the entire series. The control must be repeated at least once an hour, however, and oftener when the operator has reason to think that any of the factors indicated above have been altered, for any such alteration of conditions may change the zero point of the instrument.

In the polarization of the quartz plates, as also in the polarization

of very white sugars, difficulty may be experienced in obtaining a complete correspondence of both halves of the field. With a little practice this may be overcome and the neutral point found, but when it cannot the ordinary telescope of the instrument may be replaced by another, which is furnished with the polariscope, and which carries a yellow plate. This removes the difficulty, and renders it possible, even for one not well accustomed to the instrument, to set it at the exact point of neutrality.

348 Summarized sources of error.

88. The following principal sources of error must be especially guarded against:

1. Drying of sample during weighing.
2. Excess of subacetate of lead solution in clarification.
3. Incomplete mixing of solution after making up to mark.
4. Imperfect clarification or filtration.
5. Concentration of solution by evaporation during filtration.
6. Undue compression of the cover glasses.
7. Alteration of the temperature of room, position of instrument, or intensity of light while the observation or control observation is being made.
8. Performance of polarization with a cloudy, dim, or not completely round and sharply defined field.

REVISED REGULATIONS

GOVERNING THE

SAMPLING AND CLASSIFICATION

OF

IMPORTED SUGARS AND MOLASSES

UNDER THE

ACT OF JULY 24, 1897.

Washington:
Government Printing Office.
1899.

Treasury Department.
Document No. 2088.
Division of Customs.

SAMPLING AND CLASSIFICATION OF IMPORTED SUGARS AND MOLASSES.

TREASURY DEPARTMENT,
OFFICE OF THE SECRETARY,
WASHINGTON, D. C., *February* 17, 1899.

To collectors and other officers of the customs:

The following revised regulations governing the sampling and classification of imported sugars and molasses under the provisions

of the existing tariff are prescribed for the information and guidance of customs officers and of all concerned, and will go into effect on March 1, 1899.

O. L. SPAULDING,
Acting Secretary.

349 *Regulations.*

Sampling.

1. In sampling imported sugars the number of packages to be sampled shall conform, as far as practicable, to trade usages. Such percentages shall be sampled as in the judgment of the appraisers at the ports of New York, Philadelphia, and Boston will properly and satisfactorily represent the sugars of each mark. For the purpose of carrying out this provision the appraisers at the aforesaid ports will take such measures as will insure uniformity of action at the ports named. If the method of discharging at any of the aforesaid ports is such that it is impossible for the appraising officers to secure the desired percentage, the examiner or sampler in charge of the district shall order the United States weigher to lay out such packages as may be required for sampling purposes. In order to prevent any unnecessary labor and inconvenience relative to the designation of sample packages by the examiner or sampler in charge as herein provided, the inspector shall direct that the packages when discharged, shall be placed in the slings so that the marks may be plainly discernible to the sampling officer.

2. In the treatment of sugars under these regulations great care will be taken by samplers and other appraising officers to prevent the drying out of the samples. The samples of each mark will be placed separately in the large cans provided for the purpose, the covers of which must be kept closed, except when a can is opened to receive the sample of the mark it contains. Each can will be provided with a hasp and staple, and, after being duly labeled for identification of the mark, will be locked and forwarded to the appraiser's office in wooden chests, if practicable, which must in that case be also locked. Except as provided in paragraph 9, no general samples of raw sugars will be mixed and prepared on the wharves. The name of the sampling officer responsible for the sampling at each hatch or vessel will be placed on the label, and the examiner or sampler in charge of the district will forward the samples to the appraiser's office with a letter of transmittal as per form furnished by the department.

3. Sugars in hogsheads and other wooden packages shall be sampled by putting the long trier diagonally through the package from chime to chime, one trier full to constitute a sample, except in cases of small marks when an equal number of triers full shall be taken from each package of the mark to furnish the required amount of sugar necessary to carry out the provisions of these regulations. In the sampling of baskets, bags, ceroons and mats the short trier will be used, care being exercised to take the samples fairly from the central contents of the packages, and in such manner

that the samples from each class of packages shall be uni-
350 form in quantity. When the hard condition of the sugar renders the use of the short trier impracticable, the knife may be used.

4. The keys of the sample cans and chests shall be in possession of the examiners or samplers in charge of districts, who, with the examiners at the appraiser's office, shall have the sole custody of such keys.

5. At ports where a number of samplers are employed, no one sampler shall be continued on the same sugar district longer than one month, and a record of the assignment of the examiners and samplers shall be kept by the appraiser.

6. Sugars conveyed on lighters from the place of original discharge, before samples have been taken, shall not be removed therefrom until notice has been given by the inspector to the examiner in charge of the district of the time of their proposed removal.

7. Inspectors in charge of the vessel or district, as the case may be, shall have their permits indorsed by the examiner in charge of the district, upon the completion of the cargo, stating thereon that the samples have been obtained in accordance with these regulations.

8. In cases where vessels discharge on one district, and the sugars are lightered to another before sampling, the manifest which accompanies the lighter, and is delivered to the inspector in charge of the district where such sugars are to be weighed and sampled, shall be presented to the examiner for his indorsement, the same as in the case of an original permit. The inspector in charge of such district shall be held responsible for the treatment of all such sugars, under these regulations, the same as if working under the original permit.

9. When sugars are discharged at places where the distance makes it impracticable for the regular conveyances to call for the samples, and where special provision is made by contract for other means of transportation, an official shall be detailed by the appraiser to take charge of such samples until they reach the appraiser's stores. When such transportation, owing to accident or storm, is interfered with, one of the experts may be detailed from the sugar room to go to such place, mix the different marks, and bring the samples of such marks to the appraiser's stores.

10. In the case of sugars which have gone through a process of refining, whether above or below No. 16 Dutch standard in color, general samples shall be made up on the wharves and placed in the tin sample boxes furnished by the department, each mark being kept separate. Inspectors in charge of the vessel or district, as the case may be, shall retain such sugars on the wharf until they are sampled and the permit is signed by the examiner or samplers in charge of the district. When necessary, the United States weigher shall place such packages as may be designated in condition for sampling, upon requisition of the examiner or sampler in charge of the district. When practicable, all refined sugars
351 shall be sampled with a trier specially provided for that purpose, and such percentage shall be sampled as in the judg-

ment of the examiner will afford a fair representation of the mark. When there is doubt as to whether a sugar is raw or refined, the percentage of packages sampled and the mode of preserving the samples shall be the same as herein prescribed in the case of raw sugars.

11. It is important, in order to the successful operation of the triers, that they be kept clean and free from rust. Suitable cleaning and polishing materials will be duly supplied to the samplers, who are hereby instructed to take proper care of the implements. When sampling gummy or sticky sugars, the sampler shall frequently and thoroughly clean his trier, which must in each case be dried with a towel or drying cloth before further use. *All sugars must be drawn with dry triers.* Any failure to observe these requirements will be reported at once to the appraiser by the examiner in charge of the district, and such failure will be regarded as sufficient cause for removal.

12. Sugar closets on districts shall be substantially built and secured by locks furnished by the department. All bonded warehouses in which sugars are stored shall be provided with such closets. The keys of the district closets shall be in possession of the examiner or sampler in charge of the district, who, with the examiner in charge of the sugar room at the appraiser's office, and the sworn officers in charge of the conveyances, shall have sole custody of such keys.

13. In order that correct samples may be taken of melada and other sugar products not before mentioned, paying duty under the law by weight, the heads of the packages shall be removed and replaced by the collector's employees after the sampling has been completed. The sampling shall be done under the personal supervision of an examiner, who shall take from each package placed on end, and after removal of the head, a fair representation of its contents. The sample of each mark shall be secured for transmission to the appraiser's office, as provided in the case of sugars.

14. In the case of molasses, at least one package in every ten in the order placed for gauging, or 10 per cent. of each mark throughout the cargo, will be taken, the examining officer at the same time making careful inspection of the whole cargo in order to satisfy himself whether the molasses is uniform in character or otherwise. If such inspection shall disclose any considerable variation in the quality of the packages of the same mark a larger percentage shall be sampled, as in the judgment of the examiner may be necessary in order to secure a fair representation of the mark. If any package or packages invoiced as molasses shall, in the judgment of the examiner, have the appearance of sirup of cane juice, a separate sample from each such package, properly labeled as to mark and character, shall be taken for examination as hereinafter provided.

15. In drawing the samples care must be taken to secure a
352 fair representation of the contents of each package. General samples of the cargo shall be prepared by mixing thoroughly together the samples of each mark. From such mixed samples the cans provided by the department shall be filled, marked, and placed

in the wooden chests, which must be duly locked and labeled, as in the case of sugars, for transmission to the appraiser's office.

16. Inasmuch as the absorption of sea water reduces the polariscopic test of sugar, there shall be no allowance on account of increased weight of sugar importations due to unusual absorption of sea water or of moisture while on the voyage of importation, and the provisions of article 851 of the customs regulations of 1892 shall not apply to sugar importations. That portion of each mark that has absorbed sea water or moisture on the voyage of importation shall be sampled, tested and classified separately. Special care must be taken that such sugars are sampled so as to fairly represent the contents of the packages.

17. All sugars discharged under night permits shall be sampled as discharged or weighed.

18. All officers of the customs having duties in connection with the treatment for duty of imported sugars, are expected to cooperate and to use the utmost care and diligence so that the work of sampling and classification may be facilitated. The examiners and samplers in charge of districts shall be held responsible by the appraiser for the strict and impartial enforcement of these regulations, and to this end they shall be notified relative to the time of discharge and weighing of sugar cargoes on their respective districts by the inspector or weigher in charge of the same.

19. The appraiser shall notify the collector of the boundaries of sugar districts and the location of the examiner's office on each district, and such information will be furnished by the collector to the inspectors and weighing officers. The collector shall furnish each inspector and weigher with a copy of these regulations.

20. In order to the prompt execution of the foregoing instructions, appraisers will keep the department advised relative to the best means of securing speedy communication with the examining officers on the wharves, and the necessary measures will be taken for the frequent and expeditious transmission of samples from the wharves to the appraiser's stores.

Classification.

21. When the samples have reached the classification room in the appraiser's office, they shall be separated by marks, and each mark, or portion thereof represented by each can, shall be carefully examined with reference to its color by the Dutch standard. Should any mark, or portion thereof, be found to be close to No. 16 Dutch standard in color, it shall be examined and passed upon by two experts in the appraiser's office, and in case of disagreement between them as to the degree of color, according to the Dutch stand-
353 ard, the appraiser, or some person designated by him, shall decide between them.

22. Raw sugars found to be above No. 16 Dutch standard in color, and all sugars which have passed through a process of refining, shall be so classified, with respect to color or kind, and rate of duty. When there is a doubt as to whether a given sugar is raw or has passed through a process of refining, a sample of such sugar shall

be submitted to the laboratory for expert examination, and the report of the chemist, with his expressed opinion, shall be given due weight in determining the classification of the sugar for the assessment of duty.

23. Samples of the sugar so classified shall be preserved and sealed in glass bottles, labeled with the name of the importer, date of importation, place whence imported, name of vessel, classification, mark, number, and character of packages, and the names of the examiners who passed the same. The bottles containing such samples shall be retained by the appraiser for at least one week after the return of the invoice to the collector.

24. Raw or unrefined sugars not above No. 16 Dutch standard in color shall be separated by the experts in the examining room according to marks, and the samples of each mark shall be thoroughly mixed together, reducing if necessary by quartering, until the proper amount is secured for the general sample. From such general sample two round tin sample boxes of uniform size, made to contain not less than one pound each, shall be closely packed full of sugar, and transmitted forthwith to the laboratory for polariscopic test. The boxes must be so made as to be practically air-tight when closed. The samples of a mark first sent to the laboratory shall be known as "first samples," and shall be so entered in the Record of tests as hereinafter provided.

25. In transmitting the samples from the examiner's room to the laboratory they shall be indicated only by serial numbers, the key of which shall be kept in a permanent form in the examiner's room in the record hereinbefore mentioned, and the laboratory officers shall not be informed in any manner as to the identity of such samples.

26. In conformity with the principles of commercial usage and in order to secure correct results in the testing of sugars for the assessment of duty, it is directed that at least two tests shall be made of each sample of sugar sent to the laboratory and of its several products, as specified in the law, except molasses polarizing more than 2° above or below 40° or 56°; and the test which shall be accepted for the classification of a mark shall be an average of tests as hereinafter provided, such averages to be carried to five places of decimals when called for by the figures.

27. Samples sent to the laboratory in manner as provided in paragraphs 24 and 25 shall be carefully mixed. Sugars containing hard lumps not readily crushed and mixed by hand must be mixed in a mortar or by other adequate means. After thoroughly
354 mixing, the respective samples shall be divided into two equal portions, each of which shall be tested by different experts. Should the results of the two separate tests of a sample so correspond with three-tenths of one degree, the average of the two shall be accepted as the test of such sample.

28. Should the results not correspond within three-tenths of one degree, a third test of the sample, after remixture of the two portions, shall be made by a third expert, when practicable, and of the three tests so made the average of the two most closely corresponding

shall be accepted as the test of the sample, provided the two last mentioned tests correspond within three-tenths of one degree; and provided further, that if one of the three tests so made be the average of the other two tests and correspond with the same within three-tenths of one degree, then such tests shall be accepted as the test of the sample.

29. When two of the three tests so made do not correspond within three-tenths of one degree, a fourth test of the sample shall be made, which shall be subject to the same provisions as herein prescribed with reference to the preceding tests; but discrepancies rendering such fourth test necessary should not occur.

30. The tests of the two samples of a mark first sent to the laboratory, having been duly reported, shall be permanently entered in the record of tests according to their serial numbers, respectively, together with the accepted test of each sample, determined in a manner as herein provided. Should such accepted tests correspond within five-tenths of one degree, the average of the two shall be taken as the true test of the sugar.

31. Should the accepted tests of the first samples not correspond within five-tenths of one degree, a third sample of the mark, to be known as the "reserved sample," shall be made up from the reserved portion of the mark hereinafter provided for, in manner as prescribed for first samples, labeled with the regular serial number, and recorded; and in testing the reserved sample the rule herein prescribed for testing first samples shall be strictly observed.

32. The tests of the reserved sample having been duly reported and recorded, as provided for first samples, the accepted tests of the three samples of the mark shall be considered together. Of the three separate tests of the mark so recorded, the average of the two most closely corresponding shall be taken as the test of the sugar; but if one of the said tests be the average of the other two, it shall be taken as the correct test.

33. In order to provide for the "reserved sample" before mentioned, and for the preservation of a portion of the mark in condition as imported, it is directed that when the "first samples" are prepared and sent to the laboratory a portion of each mark, so taken as to fairly represent the entire general sample, shall be reserved—3-pound glass jars provided with ground stoppers to be used for the purpose. In all cases the jars must be firmly packed full of sugar before closing, and sealed so as to make the same air tight.
355 Such sugars, after being properly labeled for identification shall be marked "Reserved," and shall be held in safe custody in the examiner's room for use when required.

34. When the test of the sugar has been determined, in manner as provided in paragraphs 26 and 32, both inclusive, the appraiser shall immediately notify the importer, by messenger when practicable, of such test. Should the importer, within two official days after such notice has been sent to him by the appraiser, claim an error in the test so reported, and request a retest of any mark or portion of a mark, such retest may be granted, provided on evidence furnished, such claim shall appear to the appraiser to be well founded; but in

no case shall a retest be granted when the error claimed is shown to be less than four-tenths of one degree. Samples for retest shall be made up from the reserved portion of the mark and shall be treated in all respects as provided for original tests.

35. In cases of retest, the test upon which the sugar shall be classified for duty shall be the average of the original and the retest; but should conclusive evidence be furnished to the appraiser showing that such average is erroneous, it shall be competent for him to consider such evidence and to classify the mark upon the basis of the original or the retest, as may seem to him most just. In such cases all the facts shall be reported at once to the department.

36. It will be understood that in all cases where, in the judgment of the appraiser, an error has been made, the reserved portion of a mark may be resorted to by the appraiser at any time before he has made the return on the invoice for the purpose of determining and correcting such error.

37. The sample wagons shall collect samples in the morning and afternoon of each day, taking with them on each trip the samples of each mark already drawn, which must be tested promptly on arrival at the appraiser's stores, and the testing of each lot or portion of a mark so sent in shall be conducted in all respects as herein prescribed for that of an entire mark. In such cases the test of the mark shall be the average of the ascertained tests of the several lots so found, based on the proportion of the mark which each of the said lots represents. In sending notice of tests to the importer, as provided in paragraph 34, the appraiser shall furnish, in addition to the average test of the mark, the quantity and test of each lot from which such average test is obtained. In the preparation and treatment of reserved samples the same principle will hold as in the case of an entire mark.

38. In the classification of molasses, when the result of the first test is within two or 40° or of 56°, as the case may be, either above or below, the foregoing directions regarding the duplicate or triplicate test of sugars shall be followed. Importations invoiced and entered as molasses, possessing in any degree the taste or smell or other characteristic or sirup of cane juice, shall be subjected to chemical analysis and determinations will be made of the
356 percentage of water and of the cane sugar in the dry substance. For the determination of moisture in molasses, sirups and *masse cuites*, dry from 1 to 2 grams in a flat dish of not less than 7 centimeters diameter at the temperature of boiling water for two hours. Care must be taken to run the liquid in a film over the bottom of a dish, and to retain in a horizontal position during the entire operation.

39. In the event of polarization of the dry substance being above 75 per cent., the samples shall be held to be sirup of cane juice, within the meaning of the tariff; but should the polarization of the dry substance not exceed 75 per cent., the sample shall be designated as molasses, unless there be other evidence of a conclusive character to warrant its designation as sirup of cane juice.

40. It may be here stated as the view of the department that

molasses, within the meaning of the tariff, is the liquid residuum drained or purged from raw sugar, and hence is the result of a process of manufacture which has for its object the formation of sugar; while, on the other hand, sirup of cane juice is the juice of the cane highly concentrated, but not to the point of crystallization, and hence is the result of a process of manufacture having for its chief object the concentration of the juice to the point of preservation but short of crystallization.

41. A permanent record of the classification of sugars and molasses imported into the United States, subject to duty under the law, shall be kept in the examiner's room in the appraiser's office, which shall be known as the "Record of tests." In this book shall be recorded all marks of sugar received in the examiner's room, in the order in which they are examined, with their color, according to the Dutch standard, and all samples of sugar representing the same, severally, by their serial numbers, in the order in which they are sent to the laboratory, together with the tests of the same, respectively, as reported from the laboratory. Said record shall show further the nature of the samples, whether "first" or "reserved" and whether for "original" or for "re-test."

42. A permanent record shall also be kept in the laboratory of all samples received from the examiner's room, which shall be entered therein by their serial numbers in the order in which they are received; and the officer in charge of the laboratory shall report all tests made and recorded of such samples, severally, including the third and fourth tests, when made, to the examiner in charge of classifications, who shall enter such report in the Record of tests, and shall determine and record the accepted test in manner as hereinbefore provided.

43. When an invoice of sugar or molasses has been passed, the appraiser shall at once send written notice to the importer, informing him of the classification and test of his importation. On the morning of the first official day after the return of invoices to the collector covering importations of sugar or molasses, a tabulated statement of all such invoices, showing particulars of importation, the color
357 by the Dutch standard, and the ascertained polariscopic test of each mark, as per form hereto annexed, shall be conspicuously posted at the custom house for the information of the trade. Duplicate statements shall at the same time be prepared and forwarded for exchange between the ports of Boston, New York, Philadelphia, Baltimore, New Orleans and San Francisco, which, when received, shall also be conspicuously posted, as herein provided, for trade information.

44. As a means of determining relative to uniformity of results in the testing of imported sugars at the several ports, it is directed that on each alternate day, beginning with Monday, a sample of sugar shall be tested at each of the ports of Boston, New York and Philadelphia, and at the same time duplicate samples of the same sugars shall be exchanged for tests between the appraisers of the said ports. The duplicates shall be sent in the tin box prescribed in paragraph 24, which must be firmly packed full of sugar and sealed air-tight.

The samples shall be numbered at each port of importation from 1 upward, and the duplicates shall be marked for identification with the same number, the name of the importing port, and the date of test at such port.

45. Test of the duplicate samples must be made as soon as they have been received. The duplicates shall be sent to the laboratory under regular serial numbers, the identifying marks having been removed after having been first entered in a special record, together with their respective serial numbers. Samples at the port of importation and those sent for exchange shall be tested in all respects as provided in paragraphs 27 to 29, both inclusive, and the separate tests of such samples, together with the accepted tests, shall be promptly reported from each port to the department, under their respective identifying marks.

46. On each alternate day, beginning with Tuesday, a sample of sugar shall be tested in the dry substance at each of the ports named in paragraph 44, and duplicate samples of the same sugar shall at the same time be exchanged for like test between the appraisers of the said ports. The duplicates shall be prepared, marked for identification, and forwarded in manner as provided in paragraph 44. Such samples shall be sent to the laboratory as soon as received, under their respective identifying marks, and reports of tests shall be promptly forwarded from each port to the department under such marks. Such reports shall show the direct polarization, the percentage of moisture, and the test in the dry substance. When sugars are imported and tested at any port other than those named in paragraph 44 samples shall be tested in the dry substance at the port of importation, and duplicate samples shall be transmitted for like test to each of the said ports. The samples shall be prepared and reports of said tests shall be made in all respects as herein prescribed for samples exchanged and tested at the said first-named ports. Reports of tests prescribed in this and the preceding paragraph shall be made on forms provided by the department, which will be duly furnished on requisition.

358 47. In addition to the foregoing, the appraiser at any sugar importing port is hereby authorized, when in his judgment it shall be desirable, to call for a sample or samples of the reserved portions of any mark which he may select from the exchange sheets provided for in paragraph 43, for the purpose of obtaining the polariscopic test of the same at his port. Each sample shall be prepared at the port of transmittal in manner as provided in paragraph 44, and shall be labeled with the name of the importer, the date of test, the invoice mark as reported on the exchange sheets, the separate tests, and the accepted test. Such samples may be sent to the laboratory under their identifying marks or under serial numbers, as the appraiser may deem advisable. Tests of all samples shall be made and the accepted test determined in manner as prescribed in paragraphs 27 to 29, both inclusive. Should there be any material difference between the test as determined at the port of importation and the one so found, the appraiser shall take the necessary means to verify the correctness of his results, and shall in all cases

forward promptly a report of such tests, with such comments as he may deem necessary, for the information of the department.

48. Paragraph 212 of the tariff act provides in part that sugars after being refined, when tinctured, colored, or in any — adulterated, shall pay special rates of duty. In view of this provision appraising officers will cause all refined sugars to be subjected to expert examination, and will report to the collector whether the same, after being refined, have been tinctured, colored, or in any way adulterated. At ports where the Government has no facilities for making such expert examination samples of all refined sugars imported shall be forwarded to the appraiser at New York, who will cause the necessary expert examination to be made and report the results to the collector at the port of importation.

49. Sugars which are subject to the additional duty imposed under the provisions of section 5 of the tarif- act because of any bounty or grant paid or bestowed on the exportation of the same from the country of production, and the amount of such bounty or grant is made dependent on the polariscopic test of the sugar, must be subjected to such test, and report thereof will be made to the collector on the invoice, for use in liquidation; but all hard refined sugars, such as cut-loaf, crystals, crushed, or granulated, shall be deemed to have tested at least 99.5° when exported from the country of production. In all cases where the classification of imported sugar for the assessment of duty is liable to be contested, either on the question of its polariscopic test or on one arising under the provision of law referred to in the preceding paragraph, representative samples of such sugars shall be preserved in manner as provided in paragraph 33, and such samples shall be held for use until the final liquidation of the entry.

50. All samples of sugar sent to the laboratory for test must be preserved as nearly as possible in the same condition as when received, and shall be returned therefrom to the examining
359 room in such condition with the reports of the tests. All samples tested for exchange, and all exchange samples, as soon as they have been returned from the laboratory, shall be labeled with their identifying mark, securely sealed air-tight, and held in safe custody in the examining room thirty days from the date of test, for such further test or investigation as may be ordered by the department. In case any exchange sample has been received at any port not properly filled and sealed as herein prescribed, the appraiser at the port of receipt shall immediately notify the appraiser at the port of transmittal, and shall also report the facts to the department.

51. Attention is hereby particularly called to the provision of article 840, customs regulations of 1892, prohibiting the admission of all persons to the examining rooms of the appraiser's office, except officers and employees whose duties require them to have access thereto. This provision must be strictly enforced.

52. All requests for the retesting of any mark or marks of sugar shall be properly filed, and a record thereof shall be kept by the examiner in charge of classifications.

53. These regulations shall take the place of all orders or regula-

tions heretofore issued with reference to the sampling and classification of imported sugars and molasses.

54. The following is the form of statement which will be used as provided in paragraph 43, blanks for which will be furnished by the department on requisition.

Daily Statement of Classification of Sugar, etc.

U. S. APPRAISERS' OFFICE, ——, ——, 189-.

Name of importer.	Name of vessel.	Where from.	Date of entry.	Date of shipment.	Marks and plantations.	Number and kind of packages.	Kind of sugar.	Color by the Dutch standard.	Polariscopic test.	Rate of duty per pound.	Countervailing duty.	Remarks.

360 Standardization and adjustment of apparatus and instruments.

55. All polariscopes, weights, flasks, polariscope tubes, and quartz control plates used in the work of testing sugar by the polariscope will be standardized and their accuracy attested by the office of standard weights and measures, United States Coast and Geodetic Survey. They will be marked with the initials U. S. C. R., and no test of sugar will be made with apparatus which is not so marked, unless special authority is given. Each quartz control plate will be accompanied by a table giving its sugar value at temperatures of each degree centigrade from 10° to 35°, in terms of the Ventzke scale.

Proper arrangement of laboratories.

56. Plans for laboratories for the testing of sugar must be approved by the Secretary of the Treasury.

The room used for the purpose shall be one that is as far removed as possible from the vibration of machinery; it must be well lighted and have some means of artificial heating, so that the temperature may be controlled, and shall not be too near steam boilers, furnaces, flues, or any source of heat which cannot be controlled. The polariscope shall be placed in the darkest part of the room, and this part of the room may be darkened, if desired, by curtains or hangings. In no case, however, shall the polariscope be entirely separated from the room in which the test of the work is performed, as the solutions

must be made up and polarized at the same temperature. The lamp used for the illumination of the polariscope, on the other hand, must be separated from the instrument, as its heat tends to increase the temperature of the room and cause it to vary from time to time. The separation of the lamp from the instrument will be best accomplished by means of a board partition, making a separate compartment for the lamp, which may have its own window or opening for ventilation. The partition must be perforated with an opening just large enough for the passage of light to the instrument. If a separate compartment for the lamp can not be made, a wooden screen may be used, perforated in a proper manner, and placed on the table between the instrument and the lamp.

The table upon which the polariscope stands must be level, and the instrument itself must not be near any source of uncontrolled heat, and must not be exposed to the direct rays of the sun.

Instructions Relative to the Use of the Polariscope.

Definition of the word "degree" as it occurs in the act.

57. The expression, "testing * * * *degrees* by the polariscope," occurring in the act, is construed to mean the *percentage* of pure sucrose contained in the sugar, as ascertained by polarimetric estimation. Until further notice the degree of the "Ventzke
361 scale," as hereinafter defined, will be considered as indicating the correct percentage of sucrose, in the form of instrument used by this department in testing sugar. The Ventzke scale is hereby defined to be such that *one degree of the scale is the one-hundredth part of the rotation produced in the plane of polarization of white light in a column* 200 *milimetres long by standard solution of chemically pure sucrose at* 17.5° *C., the standard solution of sucrose in distilled water being such as to contain, at* 17.5° *C. in* 100 *cubic centimetres,* 26.048 *grams of sucrose.* The density of this solution will be 1.10 at the given temperature.

In this definition the weights and volumes are to be considered as *absolute*, all weighings being referred to a vacuum.

Directions for the polarization of sugar.

58. The following directions for the use of the polariscope in testing sugar are based upon the recommendations in a report made by a commission consisting of the chief chemist of the Department of Agriculture, the chemist of internal revenue, and the assistant in charge of the office of standard weights and measures, Coast and Geodetic Survey, and must be closely adhered to in all tests of sugar for classification.

Description of instrument and manner of using.

The instrument to be employed in the testing of imported sugars for the assessment of duty is known as the half shadow apparatus of Schmidt & Haensch. It is shown in the following cut:

Fig. 1.

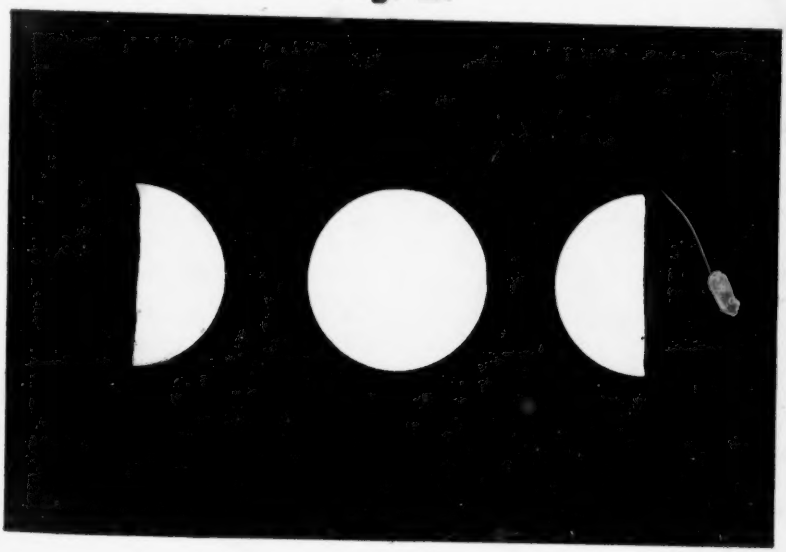
The tube N contains the illuminating system of lenses and is placed next to the lamp; the polarizing prism is at O, and the analyzing prism at H. The quartz wedge compensating system is contained in the portions of the tube marked F, E, G, and is
362 controlled by the milled head M. The tube J carries a small telescope, through which the field of the instrument is viewed, and just above is the reading tube K, which is provided with a mirror and magnifying lens for reading the scale.

The tube containing the sugar solution is shown in position in the trough between the two ends of the instrument. In using the instrument the lamp is placed at a distance of at least 200 millimeters from the polarizing end; the observer seats himself at the opposite end in such a manner as to bring his eye in line with the tube J. The telescope is moved in or out until the proper focus is secured to give a clearly defined image, when the field of the instrument will appear as a round, luminous disk, divided into halves by a vertical line passing through its center, and darker on one-half of the disk than on the other, when the compensation quartz wedge is displaced from the neutral position. If the observer, still looking through the telescope, will now grasp the milled head M, and rotate it first one way and then the other, he will find that the appearance of the field changes, and at a certain point the dark half becomes light and the light half dark. By rotating the milled head delicately backward and forward over this point he will be able to find the exact position of the quartz wedge operated by it, in which the field is neutral, or of the same intensity of light on both halves.

The three different appearances presented by the field are best shown in Fig. 2.

5 14 1/2

Fig. 2.



With the milled head set at a point which gives the appearance of the middle disk as shown above, the eye of the observer is raised to the reading tube K, which is adjusted to secure a plain reading of the divisions and the position of the scale is noted. It will be seen that the scale proper is attached to the quartz wedge, which is moved by the milled head; and attached to the other quartz wedge is a small scale called a *vernier,* which is fixed, and which serves for the exact determination of the position of the movable scale with reference to it. On each side of the zero line of the vernier a space corresponding to *nine* divisions of the movable scale is divided into *ten* equal parts. By this device the fractional part of a degree indicated by the position of the zero line is ascertained in tenths; it is also necessary to count from zero, until a line is found which makes a continuous line with one on the movable scale.

With the neutral field, as indicated above, the zero of the movable scale should correspond closely with the zero of the vernier, unless the zero point is out of adjustment.

If the observer desires to secure an *exact* adjustment of the zero of the scale, or in any case if the latter deviates more than one-half of a degree, the zero lines are made to coincide by moving the milled head and securing a neutral field at this point by means of the small key which comes with the instrument, and which fits a small nipple on the *left* hand side of F, the fixed quartz wedge of the compensation system. This nipple must not be confounded
364 with a similar nipple on the *right*-hand side of the analyzing prism H, which it fits as well, but which *must never be touched,* as the adjustment of the instrument would be seriously disturbed by moving it. With the key on the proper nipple it is turned one way or the other until the field is neutral. Unless the deviation of the zero be greater that 0.5° it will not be necessary to use the key, but only to note the amount of the deviation, and for this purpose the observer must not be content with a single setting, but must perform the operation five or six times and take the mean of these different readings. If one or more of the readings show a deviation of more than 0.2° from the general average, they should be rejected as incorrect. Between each observation the eye should be allowed a moment of rest.

The "setting" of the zero having been performed as above, the determination of the accurate adjustment of the instrument by means of the "control" quartz plates is proceeded with. One or more such plates will be furnished with each polariscope, and as their sugar values vary with changes of temperature, each plate will be accompanied by a table giving its exact value at different temperatures from 10° to 35° C.

60. The plate is placed in the instrument and the field observed; it will be seen that the uniform appearance of the field is changed. The milled head is turned to the right until the exact point of neutrality is reestablished, just as described above in setting the zero. The scale is read, the observation repeated, the reading tak*ing* again, and so on until five or six readings have been made. The average

is taken, readings being rejected which show a divergence of more than 0.2, and the result corrected for the deviation of the zero point, if any was found, the deviation being added if it was to the left and subtracted if to the right. If the adjustment of the instrument be correct, the result should be the value of the control plate used, as ascertained from the table, for the temperature of 20° C. A variation of 0.2 from the established values may be allowed for errors of observation, temperature, etc., but in the hands of a careful observer *a deviation greater than this, after a careful setting of the zero, shows that the instrument is not accurately adjusted.*

After the adjustment of the instrument the setting of the zero point is dispensed with, the indication of the scale for sugar solutions being corrected by the amount of deviation shown in the reading of the control plate from its established value as ascertained from the table, at the temperature of the room.

For example: A sugar solution polarizes 80.5; the control plate just before had given a polarization of 91.4, the temperature of the room during both observations being 25° C. According to the table the value of the control plate at 25° C. is 91.7; the reading is therefore 0.3 too low, and 0.3 is added to the reading of the sugar solution, making the corrected result 80.8. The temperature of the room must be ascertained from a standardized thermometer
365 placed close to the instrument and in such a position as to be subject to the same conditions.

The use of the new apparatus of Schmidt & Haensch, known as the triple-shadow polariscope, is also permitted and recommended. The accompanying diagram (Fig. 3) shows the appearance of the field of this instrument in the three positions of the quartz wedge.

Preparation of the sugar solution for polarization.

61. If the sample is not entirely uniform it must be thoroughly mixed before weighing, after all the lumps are broken up, best with a mortar and pestle. Then 26.048 grams are weighed on the balance in the tarred German silver dish furnished for this purpose. Care must be taken that the operations for mixing and weighing are not unduly prolonged, otherwise the sample may easily suffer considerable loss of moisture, especially in a warm room. The weighed portion of sugar is washed by means of a jet from a wash bottle into a 100 cubic centimeter flask, the dish being well rinsed three or four times and the rinsings added to the contents of the flask. The water used must be either distilled water or clear water which has been found to have no optical activity. After the dish has been thoroughly rinsed, enough water is added to bring the contents of the flask to about 80 cubic centimeters, and it is gently rotated until all the sugar has dissolved. The flask should be held by the neck with the thumb and finger and the bulb not handled during this operation. Care must be taken that no particle of the sugar or solution is lost. To determine if all the sugar is dissolved, the flask is held above the level of the eye, in which position any undissolved crystals can be easily seen at the bottom. The char-

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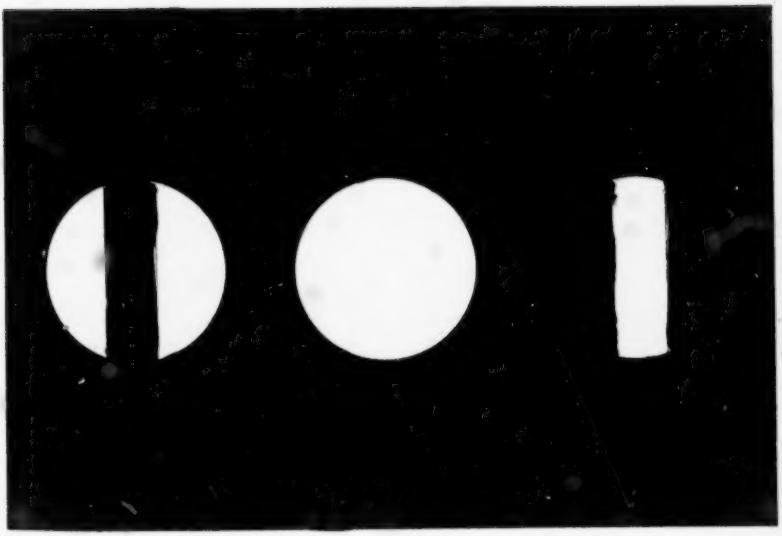
Fig. 3.



acter of the solution is now observed. If it be colorless or of a very light straw color and not opalescent, so that it will give a clear, transparent liquid on filtration through paper, the volume is made up directly with water to the 100-cubic-centimeter mark on the flask. Most sugar solutions, however, will require the addition of a clarifying or decolorizing agent, in order to render them sufficiently clear and colorless to polarize. In such case, before making up to the mark, a solution of subacetate of lead is added.*

The quantity of this agent required will vary according to the quality of the sugar. From 20 to 60 drops (1 to 5 cubic centimeters) will answer for most sugars; for molasses more may be required.

62. After adding the solution of subacetate of lead the flask must be gently shaken, so as to mix it with the sugar solution. If the proper amount has been added, the precipitate will usually subside rapidly; but if not, the operator may judge of the completeness of the precipitation by holding the flask above the level of the eye and allowing an additional drop of subacetate of lead to flow down the side of the flask into the solution. If this drop leaves a clear track along the glass through the solution, it indicates that the precipitation is complete. If, on the other hand, all trace of the drop is lost on entering the solution, it indicates that an additional small quantity of the subacetate of lead is required. The operator must learn by experience the point where the addition should cease; *a decided excess of subacetate of lead solution should never be used.*

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The use of subacetate of lead should, in all cases, be followed by the addition of "alumina cream,"† in about double the volume of the subacetate solution used, for the purpose of completing the clarification, precipitating excess of lead, and facilitating filtration. In many cases of high-grade sugars, especially beet sugars, the use of alumina cream alone may be sufficient for clarification without the previous addition of subacetate of lead.

The solution is now made up to the mark by the addition of distilled water in the following manner: The flask, grasped by the neck between the thumb and finger, is held before the operator in an upright position, so that the mark is at the level of the eye, and water is added, drop by drop, from a siphon bottle or wash bottle, until the lowest point of the curve or meniscus formed by the surface of the liquid just touches the mark. If bubbles hinder the operation they may be broken up by adding a single drop of ether, or a spray from an ether atomizer, before making up to the mark.

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*Prepared as follows: Boil an aqueous solution of lead acetate with an excess of lead oxide (PbO) for half an hour, and make filtered solution of a concentration of about 1.25 specific gravity. Solid subacetate of lead may be substituted for the normal salt and oxide in the preparation of the solution.

†Prepared as follows: Shake powdered commercial alum with water at ordinary temperature until a saturated solution is obtained. Set aside a little of the solution, and to the residue add ammonia, little by little, stirring between additions, until the mixture is alkaline to litmus paper. Then drop in additions of the portions left aside until the mixture is just acid to litmus paper. By this procedure a cream of aluminum hydroxide is obtained suspended in a solution of ammonium sulphate, the presence of which is not at all detrimental for sugar work when added after subacetate of lead, the ammonium sulphate precipitating whatever excess of lead may be present.

The mouth of the flask is tightly closed with the thumb, and the contents of the flask are thoroughly mixed by turning and shaking. The entire solution is poured upon the filter, using for this purpose a funnel large enough to contain all the 100 cubic centimeters at once, and a watch glass is placed over the funnel during filtration to prevent a concentration of the solution by evaporation.

The funnel and the vessel used to receive the filtrate must be perfectly dry. The first portion of the filtrate, about 20 to 30 cubic centimeters, should be rejected entirely, as its concentration may be affected by a previous hygroscopic moisture content of the filter paper. It may be necessary to return subsequent portions to the filter until the liquid passes through perfectly clear.

If a satisfactory clarification has not been obtained, the entire operation must be repeated, since *only with solutions that are entirely clear and bright can accurate polarimetric observations be made.*

368 63. If the solution be still too dark to polarize, even in the 100-mil-imeter tube, as in the case of dark-colored molasses, it may be decolorized by means of bone black. The use of this clarifying agent should be avoided if possible, however, on account of its well-known property of absorbing sugar. If its use is found absolutely necessary, a fresh solution is prepared, and before filtration 4 or 5 grams of dry bone black are placed in the apex of the filter paper. The first 50 or 60 cubic centimeters of the filtrate must be rejected.

When a sufficient quantity of the clear liquid has passed through the filter, the 200-millimeter observation tube is filled with it. The 100-millimeter tube should never be used except in the rare cases when, notwithstanding all the means used to effect the proper decolorization of the solution, it is still too dark to polarize in the 200-millimeter tube. In such cases the shorter tube may be used, and its reading multiplied by two, but the zero deviation must then be determined and applied to the product. This will give the reading which would have been obtained if a 200-millimeter tube could have been used, and it only remains to apply the correction determined by the use of the control plate as previously described.

Example:

Solution reads in 100-millimeter tube	47.0
Multiplied by 2	2.0
Product	94.0
Zero reads plus 0.3	0.3
Solution would read in 200-millimeter tube	93.7
Reading of control plate	90.4
Sugar value of control plate	90.5
Instruments too low by	0.1
Add 0.1 to	93.7
Correct polarization of solution	93.8

Before filling the tube it must either be thoroughly washed and dried or rinsed several times with a portion of the solution itself. The cover glasses must also be clean and dry and without serious defects or scratches. Unnecessary warming of the tube by the hands during the filling should be avoided. It is closed at one end with the screw cap and cover glass and grasped by the other end with the thumb and finger. The solution is poured in until its curved surface projects slightly above the opening, the air bubbles allowed time to rise, and the cover glass pushed horizontally over the end of the tube in such a manner that the excess of liquor is
369 carried over the side, leaving the cover glass exactly closing the tube, with no air bubbles beneath it, and with no portion of the liquid upon its upper surface. If this result is not attained the operation must be repeated, the cover glass being rubbed clean and dry, and the solution again brought up over the end by adding a few more drops. The cover glass being in position, the tube is closed by screwing on the cap. The greatest care must be observed in screwing down the caps that they do not press too tightly upon the cover glasses. By such pressure the glasses themselves may become optically active and cause erroneous readings when placed in the instrument. It must therefore be ascertained that the rubber washers are in position over the cover glasses, and the caps should be screwed on lightly. It must also be remembered that a cover glass, once compressed, may part with its acquired optical activity very slowly, and some time must be allowed to elapse before it is used again.

64. The polariscopic reading may now be taken, an observation on the control plate having been made immediately before, as previously described. Then, *without altering the position of the instrument relative to the light, or changing the character of the latter in any way*, the tube filled with the sugar solution is substituted for the control plate. The telescope is adjusted, if necessary, so as to give a sharply defined field, which must appear round and clear. This condition *must be fulfilled* before the observation is performed, as it is essential to accuracy. The milled head is turned until the neutral point is found, and the reading is taken exactly as previously described, the operation repeated five or six times, the average taken with the rejection of aberrant readings, the average figure corrected for the deviation shown by the control observation from the sugar value of the control plate at the temperature of observation as given in the table, and the result taken as the polarization of the sugar. When a series of successive polarizations is made under the same conditions as regards temperature, position of the instrument with relation to the light, intensity of the light, etc., the control observation need not be made before each polarization, one such observation being sufficient for the entire series. The control must be repeated at least once an hour, however, and oftener when the operator has reason to think that any of the factors indicated above have been altered, for any such alteration of conditions may change the zero point of the instrument.

In the polarization of the quartz plates, as also in the polarization

of very white sugars, difficulty may be experienced in obtaining a complete correspondence of both halves of the field. With a little practice this may be overcome and the neutral point found, but when it can not the ordinary telescope of the instrument may be replaced by another, which is furnished with the polariscope, and which carries a yellow plate. This removes the difficulty and renders it possible, even for one not well accustomed to the instrument, to set it at the exact point of neutrality.

370 Summarized sources of error.

65. The following principal sources of error must be especially guarded against:

1. Drying of sample during weighing.
2. Excess of subacetate of lead solution in clarification.
3. Incomplete mixing of solution after making up to mark.
4. Imperfect clarification or filtration.
5. Concentration of solution by evaporation during filtration.
6. Undue compression of the cover glasses.
7. Alteration of the temperature of room, position of instrument, or intensity of light while the observation or control observation is being made.
8. Performance of polarization with a cloudy, dim, or not completely round and sharply defined field.

371 United States Circuit Court, Southern District of New York.

No. 2918.

BARTRAM BROS.
vs.
THE UNITED STATES.

No. 2919.

BENJAMIN H. HOWELL, SON & CO.
vs.
SAME.

No. 2920.

THE AMERICAN SUGAR REFINING CO.
vs.
SAME

To the circuit court of the United States for the southern district of New York:

The undersigned, a general appraiser under the act of June 10th, 1890, to whom it was referred by this honorable court by an order made August 7, 1899, to take further evidence in the above-entitled

matter, do hereby return such further evidence taken by me pursuant to such order.

Dated New York, June 20, 1901.

W. B. HOWELL,
United States General Appraiser, as an Officer of the Court.

United States Circuit Court, Southern District of New York.

No. 2918.

BARTRAM BROS.
vs.
THE UNITED STATES.

No. 2919.

BENJAMIN H. HOWELL, SON & CO.
vs.
SAME.

No. 2920.

THE AMERICAN SUGAR REFINING CO.
vs.
SAME.

NEW YORK, *August* 8, 1899.

Before Hon. J. B. Wilkinson, Jr., as officer of the court.

Appearances.

For the importers: John E. Parsons, H. B. Closson and A. K. Tingle.

For the United States: Henry C. Platt, ass't U. S. attorney.

EDWIN WOLFBAUER, called as a witness on behalf of the importers, being duly sworn, testified as follows:

By Mr. TINGLE:

Q. Mr. Wolfbauer, what is your occupation?

A. My present occupation is superintendent of the Standard Beet Sugar Company, in Ames, Nebraska.

372 Q. What is your vocation there? What is your business?

A. My vocation is chemist and mechanical engineer, and my specialty has always been, at least for a good many years, as sugar manufacturer.

Q. In your examination before the board of general appraisers in describing the result of tests made by you of certain chemically pure sugar you said: "I experimented to convince myself that it was free from raffinose."

A. Yes, I so stated.

Q. What experiments did you make to ascertain that fact?

A. There is only one method known amongst scientific and practical men; that is the Clergt test. The method consists in inverting the sucrose present in the sample, and determining the polarization after such inversion by means of a calculation, based on Clergt's formula, the correct contents of sucrose is obtained. In case this figure agrees with the direct polarization the sugar is free from raffinose.

Q. You adopted this process to ascertain that fact?

A. I adopted this process to ascertain the purity of the sugar, with which I executed the experiments to which I testified before, and found the sugar to be entirely free of raffinose.

Q. Please state what raffinose is.

A. Raffinose is a kind of sugar, in the scientific sense of the word sugar. Its peculiarity by which it is specially noticed is the shape of its crystals and its quality to turn the plane of the polarized light considerably more than sucrose.

Q. How does it originate?

A. As to the origin of raffinose two theories have been promulgated; one is called the accumulation theory and the other one is the chemical formation theory. The accumulation theory supposed that raffinose was present in the beets and that it accumulated in the after products. The other theory assumes the formation of raffinose by the action of bases like lime baryta, strontium, etc., under certain circumstances, on the sucrose. The second theory has been sustained more than the first one by the fact that raffinose is never found except in sugars that have been made in refineries which employ either the baryta process, strontium process or Steffen's process. The sugar houses not employing those processes have never had any trouble with raffinose. The trouble of the raffinose consists in the occurrence of pointed crystals instead of the usual square crystals of sugar. It *it* avoided even in those factories where they employ these processes by turning out every six to eight weeks the entire production of molasses, that is, rejecting it, removing it. It never occurs in cane sugars, because cane molasses is never worked by either of those processes, as they are impracticable and uneconomical in such a case.

Q. You are acquainted generally with the methods employed in the refineries of the United States?

A. Yes, I am.

373 Q. Does any refinery in the United States employ any of those processes to which you referred which are liable to produce raffinose?

A. With the exception of some refineries out West which work beets and turn beet sugar directly into refined sugar, there is no other refinery in the United States where any of those processes are employed.

Q. Where was the refined sugar that you employed in your experiments, to which you testified before the board, made?

A. Made in the house belonging to the American Sugar Refining Company, called Havemeyer & Elder Company, in Brooklyn.

Q. Does that refinery use any of those molasses processes referred to by you?

A. No, it does not, for the simple reason that they almost exclusively work cane, and at that time they were working cane.

Q. Do you know whether the sugar you used at that time was the product of raw cane or raw beet?

A. I know from information that it was made from raw cane exclusively.

Q. In regard to what is known as the polariscopic test of sugar does it indicate with the delicacy and refinement of modern science the true content of sucrose in a sample of sugar as generally made, as tests are usually made?

A. It does only under certain limited circumstances.

Q. State what those are?

A. The polariscopic test, even if it be executed with all refinement and all precaution of science, will only show the sucrose contained in the case of a sample of sugar which does not contain any other optically active substance as all our sugars do contain.

Q. The regulations, paragraph 57, contain this statement: "The expression testing * * * degrees by the polariscope, occurring in the act, is construed to mean the percentage of pure sucrose contained in the sugar, as ascertained by polarimetric estimation. Until further notice the degree of the Ventzke scale, as hereinafter defined, will be considered as indicating the correct percentage of sucrose in the form of instrument used by this department in testing sugar." According to your definition of the polariscopic test is that a correct definition of the degrees by the polariscope?

A. Certainly not. In case of raw sugar there are other optically active substances present which influence the polariscope. Besides the execution of the ordinary polariscopic test precludes any such definition. In case, for instance, of a certain sugar we have quite a large quantity of a clarifying agent and we get a heavy precipitate, therefore a more concentrated solution, which will certainly polarize considerably higher on that account, even if there was no other optically active substance present. A further proof of the fallacy of such a statement lies in the fact that both the trade, the Government, the refiner and the raw sugar manufacturer, when they
374 determine what they call polarization, do not take any regard to the invert sugar content, which certainly is considerably influenced in the result of the polarization. All those differences in raw sugars between the true sucrose content and the polariscopic test, even if such be executed with all accuracy of science and the highest improved scientific instruments, will always be apart by from three-tenths up to about three per cent. The other optically active substance- outside of invert sugar, which influence the polarization, as, for instance, the caromelization products, frequently formed when sugars are boiled in insufficiently clean pans with live steam of high temperature, or in the open kettle process which is very largely used in the tropics. The only scientific way and the only correct way to get the true sucrose content is not the polariscopic test, but is the combination of two polariscopic tests known as the Clergt method.

Q. Then you make a distinction between the polariscopic test as such and the ascertainment of the true sucrose contents of sugar?

A. Certainly, there is a considerable difference between the two, the difference that I stated before.

Q. The polariscopic test ascertains the sucrose contents sufficiently for practical purposes of trade, does it not?

A. It does approximately; and the trade only accepts the polariscopic test in combination with another statement as to the kind of sugar it applies to; for instance, in case of beet sugars, the ash test, or mentioning the fact if it be a first, second or third sugar, or if it be a centrifugal muscovada, stroop or molasses sugar.

Q. You are acquainted with Harvey W. Wiley?

A. Yes.

Q. You were present when he gave his testimony before the board of general appraisers?

A. Yes, I was.

Q. Do you remember his reference to a paper that he read before the Third International Congress of Applied Chemistry at Vienna in August, 1898?

A. I remember him referring to that paper?

Q. I have here the Journal of the American Chemical Society for July, 1899, in which is a paper entitled "The influence of temperature on the specific rotation of sucrose and method of correcting readings of compensating polariscopes therefor," and in a note below "Read before the American Chemical Society and section C of the American Association for the Advancement of Science at Boston meeting, August, 1898, and before the Third International Congress of Applied Chemistry, Vienna, August, 1898." I hand you this paper, Mr. Wolfbauer; please state whether you have examined it?

A. I have examined and read and studied the paper carefully.

Mr. TINGLE: I ask to have this paper marked for identification.

Said paper marked "Exhibit Z for identification, August 8, 1899."

375 Q. Have you found any scientific inaccuracies in that paper?

A. I have found certain scientific inaccuracies; for instance, when the author speaks on page 577 of readings made of identical sugar solutions, made under identical circumstances and made at identical temperatures, he gives readings which vary in one case eighteen one-hundredths of one degree, and right on the same computation there is another two readings which vary sixteen one-hundredths, and the circumstances are identical, the only difference being the color of the light. It is an acknowledged and unquestionable fact that the maximum difference of light would justify perhaps two one-hundredths, though usually in those scientific investigations in the average of many readings it don't show any. A difference of eighteen one-hundredths would even be regarded as objectionable in purely commercial and factory work, not to speak of the scientific investigation. A further inaccuracy is on page 594; it shows in the computation of all the results obtained in the experiments, where he told the averages representing the influence of tempera-

ture and the specific rotatory power. It shows that the influence of the temperature for the range between 25 and 30 degrees centigrade is almost twice as large as between 20 and 25, and again between 30 and 35, which are the next adjoining ranges; between 35 and 40 again the difference chooses to be larger yet than between 25 and 30. Those differences are certainly against all rules of variations in physical laws. But not to speak of that the author simply adds them up and averages all those differences. If we take his average and compare it with the highest figure and with the lowest figure, we find that it differs in value an average of 33 per cent. one way and 46 per cent. the other way, which means that the work had been executed with the factor of inaccuracy of 79 per cent. To explain that statement in more popular language, easier to comprehend, we are entitled to compare it with an analogous case. Suppose a man was measuring a piece of cloth and he found it, after making a series of measurements, to be a minimum 25 inches long and a maximum 52 inches, and then he would simply add up all his measures and find the average and call it a yard.

Cross-examination by Mr. PLATT:

Q. Do you know Dr. Wiley?

A. I have met Dr. Wiley, yes.

Q. Is he considered an authority in such matters as these that you have referred to?

A. Not to my knowledge. He has written scientific books; I know the books he has written and published. I don't know if he is regarded as an authority or not.

Q. Do you regard him as an authority on these matters?

A. According to my statement, I must decline to do so.

Q. How many years' experience have you had as a chemist?

376 A. Ten.

Q. Where?

A. In Austria, with the Austrian Sugar Syndicate; with the Association of Sugar Manufacturers. I stated that in my direct-examination.

Q. You were examined as a witness before the board of appraisers?

A. Yes; I testified there.

Q. How long have you been in this country?

A. Six and a half years, almost seven years.

Q. What business or profession have you been engaged in during those six and one-half years?

A. During those six and a half years I have been mostly engaged in the sugar industry.

Q. Are you an employee of the American Sugar Refining Company?

A. I am employed by the Standard Beet Sugar Company of Ames, Nebraska.

Q. Have you been with that company ever since you came to America?

A. No; I am only employed by them lately.

Q. How long have you been in their employ?
A. I am only in their employ since about one week, since the first of August.
Q. Prior to that?
A. Prior to that I was employed by Mr. Sherer.
Q. Did you ever make any examination of the particular sugars imported in these cases?
A. No; I may have, but I did not compare them.
Q. Did you ever make any polariscopic test of any of those particular sugars?
A. I might have; not to my knowledge.
Q. You spoke of making a test of some chemically pure sugar?
A. Yes, sir.
Q. At whose request?
A. I think it was at Mr. Sherer's request.
Q. When?
A. I stated that in my direct examination; about a year ago.
Q. Did he furnish the samples of sugar?
A. No. I got the samples from the American Sugar Refining Company.
Q. Have you ever been engaged in the buying and selling of sugar in this country?
A. No, I have never been.
Q. Not in the trade?
A. I have been in contact with the trade in testing.
Q. As a chemist?
A. Yes.
Q. But commercially you have not been in the trade?
377 A. I have not dealt in sugar, no; I have not been a sugar broker.
Q. Is it your idea that any correct polarization can be made of sugars not chemically pure?
A. Not of commercial raw sugars.
Q. Is it your idea that any correct polariscopic test can be made of sugars not chemically pure?
A. Yes, by Clergt's method, as I have stated, but not by direct polarization.
Q. Are you about to leave the country?
A. No. I am about to go to California.
Q. When do you expect to return?
A. It is very uncertain; some time next spring.
Q. Your address will be where?
A. My address will be the Standard Beet Sugar Company, Ames, Nebraska.
Q. What is your age?
A. My age is 28.

Redirect examination by Mr. TINGLE:

Q. In answering Mr. Platt's question as to whether a correct polariscopic test could be made except of chemically pure sugar, you had reference then to the correct sucrose content?

A. The correct sucrose content. I think I stated so; it was my intention to state so.

Q. You didn't mean to say that a correct polariscopic test as generally understood in the trade could not be made of any sugar?

Mr. PLATT: Objected to on the ground that the witness is not a trade witness; he is a scientific witness.

The REFEREE: He is a trade chemist.

A. Yes.

Q. Can a correct polariscopic test of sugar, of any sugar, raw or refined, as understood by trade chemists, be made?

Same objection; objection overruled; exception.

A. Certainly.

Q. As stated by you in your direct examination, such a test would not represent the true sucrose content?

A. It certainly will not represent the true sucrose content, but it would represent what is understood as polariscopic test.

Recross examination by Mr. PLATT:

Q. What do you understand by polariscopic test?

A. Polariscopic test is the reading obtained on the Ventzke scale of a correct polariscope, by means of dissolving 26.048 grains of the sugar in question, in a flask graduated to 120 Mohr cubic
378 centimetres, under the addition of necessary clarifying agents, and such solution being filled in a 200 millimetre tube, which tube is inserted in the instrument; all these preparations being done and executed at one and the same temperature the result will be the polariscopic test.

Q. What do you mean by trade chemists?

A. I mean by trade chemists chemists that are employed by the trade either in buying or selling sugar or in the manufacture of sugar.

Q. Now, in making a correct polariscopic test of sugar ought there to be any difference in the result between a test made by trade chemists and any other competent chemists?

A. Certainly not, if the other chemist is competent.

By Mr. TINGLE:

Q. When you say chemists employed by the trade in buying and selling sugar you don't mean chemists ever buy or sell sugar, do you?

A. I said they are employed by the trade in buying sugar and they can only be employed by the trade for testing sugar.

Q. You mean by the trade when they are buying or selling sugar?

A. Yes.

Q. Employed by the trade for what?

A. To test the sugar and determine the polariscopic test.

Adjourned without fixing date.

United States Circuit Court, Southern District of New York.

No. 2918.

BARTRAM BROS.
vs.
THE UNITED STATES.

No. 2919.

BENJAMIN H. HOWELL, SON & CO.
vs.
SAME.

No. 2920.

THE AMERICAN SUGAR REFINING CO.
vs.
SAME.

Hearing resumed February 1, 1900.

Before Hon. William B. Howell, as officer of the court.

Appearances.

For the importers: John E. Parsons, H. B. Closson and A. K. Tingle.
For the United States: Henry C. Platt, ass't U. S. attorney.

JOHN BURCHMORE HARRISON called as a witness on behalf of the *the* United States, being duly sworn, testified as follows:

By Mr. PLATT:

Q. Mr. Harrison, where do you reside?
A. In Georgetown, British Guiana.
Q. What is your profession or occupation?
A. I am Government analyst for that colony.
Q. How long have you held that position?
A. I have held that position since October, 1889, and previously to that I was professor of chemistry in Barbadoes, from May—I was appointed in May, from September, 1879 to 1889.
Q. And from 1889 to the present date have you been the Government analyst at British Guiana?
A. Yes.
Q. In the performance of your duties as Government analyst have you had any experience in the polarization of sugars?
A. Yes.
Q. Will you please state what experience you have had with the use of the polariscope for testing sugars?

A. I have been using the polariscope for testing sugars continuously since 1883—I think that was the first year we commenced—1882 or 1883, I couldn't say for certain.

Q. Were sugars bought and sold in the West Indies by polariscopic tests after the year 1881?

380 A. Yes, they have been since then.

Q. And also in British Guiana?

A. Yes.

Q. Have you found in your experience in testing sugars by the polariscope that the temperature exerts influence upon the polarization of sugar solution?

A. Yes.

Q. What has been your experience in that respect?

A. My experience has been that, both with instruments using sodium light and reading angular degrees and with instruments with quartz compensators, the temperature exerts an effect on the readings.

Q. To what extent?

A. That varies with the construction of the instrument; with the sodium light ones of angular degrees the extent is about .2 of one degree for our temperature, for the difference between 17.5 and 28° C., which is our average temperature in British Guiana; with the quartz compensators the difference is from 3 to 34 of one degree for the same range of temperature; that is, taking the Ventzke instruments; that with an accurate instrument, if we make up the makers' normal weight to the normal volume that sugars which should polarize 96 or would polarize 96 at 17.5° C., polarize from 95.65 to 95.7.

Q. In making tests in your experience has any correction been made for this temperature?

A. Yes, I have invariably made the correction for it.

Q. For how many years has that practice obtained in your country?

A. With my own personal practice for about 17 years; in British Guiana in the records of my department since 1882, for 18 years.

Q. Now in commercial transactions, in the buying and selling of sugar, is this custom also observed?

A. It has in those colonies.

Q. For how many years?

A. Since we first commenced to polarize sugar, since they were first sold by polarization there.

Q. Since 1881?

A. Since 1881 or 1882.

Q. Have you with you any official or other reports showing this?

A. Yes, I have some official reports here. These (producing two documents) are two departmental reports made by my predecessor in British Guiana, one being dated 1883 and the other 1886. In the 1883 one he merely mentions that he had succeeded in getting his polarizations correct. In the one for 1886 he first described the method used for obtaining chemically pure sugar. He then wrote (reading): "Repeated experiments with the pure substance thus

obtained proved the normal weight of sugar required to polarize 100 divisions on the laboratory instrument to be 26.126 grammes,
381 dissolved in water to exactly 100 cubic centimetres, at a temperature of 28° C. The sugar weight on which the instrument is nominally graduated, at 17.5° C., is 26.048 grammes, but that weight causes a deviation of only 99.70° divisions instead of 100."

Said reports above produced offered in evidence; same received in evidence and marked, the one dated 1883 Exhibit A, one dated 1886 Exhibit B.

The WITNESS (continuing):

I have here some old duplicate books in the handwriting of my predecessor, departmental books, and they show that in each case he made an addition of .3 to the reading of the polariscope for that correction. These books are of varying dates, and range from November, 1882, these seem to be 1883 (indicating) and these are some in 1883 and 1885. They are old books that I found lying about there.

Q. What was the allowance of .3 for?

A. That allowance of .3 is the correction for the temperature between the standard temperature at which the instruments were made and the temperature at which they were used.

Said three books produced by the witness as above offered in evidence; same received in evidence; book dated November, 1882, marked Exhibit C; book dated June, 1883, marked Exhibit D, and book bearing dates 1884, 1885 and 1886, marked Exhibit E.

Q. Have you any other documents relating to this subject?

A. Here is a newspaper report of a paper that I read in 1883 on the standard method for examining sugars by the polariscope.

Q. Is that a correct report of your paper?

A. No, it is not a correct report; there are errors in it.

Q. Have you any report of that same document?

A. Yes; the only difference is that at the time it was read to the newspaper I didn't know that corrections were being applied elsewhere; afterwards I knew corrections were being applied in this country. I have here a report that was read before the Royal Agricultural and Commercial Society of British Guiana in 1895. It had been read before the meeting of October, 1894, and laid over. This is practically a correct report.

Q. That is your work, is it?

A. This is my work.

Q. The result of your experience.

A. This is the result of my experience.

Q. What is there in that, if anything, that would throw light on the subject under consideration?

A. I wrote (reading):

"It is well known that polariscopes of the Soleil Duboseq, of the "Soleil-Scheibler-Ventzke, of the Schmidt & Haensch shadow, and "of the Laurent ordinary light construction, when used at tropical

" temperatures with solutions made by dissolving the makers'
382 " normal weights of chemical pure sucrose to a bulk of one
" hundred cubic centimeters, never, if correctly adjusted by
" the makers, at a normal temperature of 17.5 deg. C. (63.5 deg. F.),
" give readings of 100 deg., but readings varying from 99.6 to 99.78.
" That is, that working with these instruments in the exact manner
" laid down by their makers, but at temperatures of about 80 deg.
" F. instead of about 60 deg. F., the instruments show from .3 to .4
" of one per cent. less than the true sugar polarizations. In conse-
" quence, a sugar which polarizes 96 deg. when examined at the
" normal temperature for which the instruments are constructed,
" will, if normal weights are made up to normal volumes at our
" prevailing temperature (temperature being the only factor vary-
" ing) polarize only about 95.7. These instruments all show the
" sugar percentages by means of quartz plate compensators.

" In instruments using monochromatic light (the light from a
" flame colored by sodium) and in which the readings are obtained
" by the rotation of the analyser, the readings of a sugar showing
" 100 deg. when tested at 63.5 deg. F. give only 99.85 at 86 deg.
" These errors arise from two causes.

" First. The rotatory power of quartz for light increases with the
" temperature, thus requiring a greater weight of sugar to produce
" a definite degree of rotation at high temperatures than at low ones.

" Second. The rotatory power of sucrose solutions decreases slightly
" by rise of temperature (irrespective of change of volume) and this
" has the same effect upon the polariscope indications.

" In addition to these, which are the primary causes of error, some
" instruments are furnished with metal scales, which, by their ex-
" pansion, add very slightly to them."

I wrote further:

" The effects of these errors can easily be calculated, but owing to
" the fact that the rotatory power of quartz is not absolutely in-
" variable in different specimens, it is far preferable to standardize
" the polariscopes under the exact conditions in which they are to be
" used, than to apply calculated corrections."

I wrote further:

" It has been my practice, whilst I have been in the West Indies,
" to standaridize all the measuring instruments used to true cubic
" centimeters, and to set the polariscopes by ascertaining either the
" necessary corrections or the true normal weights by the use of
" solutions of chemically pure sugar. The late Mr. Francis in-
" variably used the same method, and it is that used by certain of the
" more highly qualified chemists in this colony."

I gave the results of taking the normal weights to normal volumes on my own standard instruments, some of which are my property and some of which are the property of the Government.

Mr. PLATT: I offer in evidence the copy produced by the witness, of The Journal of the Royal Agricultural and Commercial
383 Society of British Guiana, of December, 1895, and especially the pages containing the report of Prof. Harrison.

Same received in evidence and marked Exhibit F.

Q. From what pages did you read in Exhibit F?

A. Pages 378 and 379.

Q. Your report is contained between what pages there?

A. Between pages 378 and 382. And I will read the last paragraph of it. I wrote:

"As the range of temperature here is not very great, I consider "that the method used in the Government laboratory for the last "fourteen years is the best. Each 100 cubic centimeter flask in use "for sugar polarizations is verified by weighing into it 99.533 grams "of recently boiled distilled water at 28 deg. C. The exact weight "of chemically pure sugar, which, when made up to a bulk of 100 "cubic centimeters in one of the corrected flasks at 28 deg. C., gives "a polarization reading of 100 deg., is ascertained by experiment "for each instrument and this weight of sugar is invariably used "instead of the makers' normal weight of 17.5 deg. C."

Q. Now, Mr. Harrison, in Exhibits C, D and E, are those the records of actual tests of sugar that were made?

A. Those are records of actual tests of sugar made by my predecessor and entered into these official record books.

Q. And do those actual tests show that in every case an addition of .3 was added to the polarized reading to get the correct test?

A. I think in every case.

Q. Have you any other reports or documents with you?

A. No. The method mentioned in here (referring to Exhibit F) was accepted by the Planters' Association of British Guiana as the official method for polarizing sugars in that colony, in June, 1894, when the question came up.

Q. How about the methods for buying or selling sugars?

A. The sugars are bought and sold very frequently under my test directly, but always subject to a reference to us in case of discussion.

Q. Are the same methods pursued in making tests in trade and commerce?

A. Yes, in my laboratory.

Q. Have you read the regulations of the Secretary of the Treasury of October 27, 1897?

A. Yes.

Q. What have you to say in regard to the directions contained in those regulations as to producing a correct polariscopic test?

A. They should produce a correct polariscopic test of sugars, irrespective of temperature, as far as correct determinations of sucrose can be made, by this straight optical method, by the single polarization; I mean a direct polarization, not one of invert sugar.

Q. Now, Mr. Harrison, as an expert chemist and analyzer
384 and polarizer of sugar, if those regulations were put into practical operation would they result in as correct a polariscopic test of sugar as could be made?

A. No, they couldn't, for sugar determinations; but they would result in as correct direct polariscopic test as you could make, as you could make according to the recognized methods of making direct polariscopic tests. You could make as correct tests as could be

made in the way that it is recognized for making direct polariscopic tests for sugar or simple polariscopic tests.

Q. That is, as correct as you could make according to those methods?

A. According to the recognized methods of making polariscopic tests.

Q. Go on and explain what you meant by that.

A. I mean this, that the results with chemically pure sugars would be exact; the results with ordinary sugars would not be absolutely exact determinations of sucrose, because first of all you would have to take into consideration the volume of the lead precipitate and of any clarifying insoluble substance added; that would tend of course to make it a little too high; the error introduced by that would vary with the sugar; it would be very small, probably less than a tenth with 95 to 96 per cent. crystals, and it would increase in accordance with the amount of impurities in the sugars. Then again there would be errors that were due to the presence of glucose or other substances affecting the rotatory power: this would be very small and practically insignificant with sugars polarizing from 90 upwards, especially with vacuum pan crystals. That is due to the fact that the glucose present in normal cane juice is optically inactive; and that the proportion of dextrose and levulose present in normal cane juice—I am speaking of tropical cane juice—are such as to neutralize each other's action. In the low sugars, such as molasses sugars and open pan Muscovado sugars, there you get optically active glucose which would interfere with the polarization by lowering the apparent results; it is left-handed in this.

Q. Wouldn't these same objections obtain in any polariscopic test in use?

A. Any polariscopic test that would be practically applied. By the others men would never get through their business.

Q. I am speaking of any practical polariscopic test; that is what I mean my question to be confined to, not to any absolutely scientific nicety. What have you to say to that as to these regulations?

A. I say that these regulations would give as accurate results, irrespective of the temperature, instruments, and of the solutions, as could be obtained in a simple manner.

Q. Now, what do you mean by a polariscopic test of sugar?

A. I understand by a polariscopic test of sugar, the readings given by a polariscope when you use such a weight of sugar made up to a normal bulk that if it was chemically pure sugar would read
385 100°. I understand that the test takes the readings of the raw sugars on an instrument that would show 100° where you had 100% of chemically pure sugar present in the normal volume.

Q. What is the object of the polariscopic test?

A. It is to obtain the nearest practical approximation with the greatest accuracy to be obtained practically, to the true sugar content. Of course I say practically in each of those cases.

Q. And in your opinion as an expert would the direction contained in those regulations lead to that result?

A. They will and they do. And it has been decided at the last conference of West Indian government analysts to adopt this method in future, by using your method of corrections by quartz plates rather than our former one by ascertaining the absolute normal weights for the temperatures.

Q. Is this allowance of correcting for temperature that you speak of a part of the correct polariscopic test of sugar?

Mr. PARSONS: Objected to. I understand that he has adopted a system.

The WITNESS: I adopted the same system, applied in a different way.

Q. (Question as above repeated.)

A. It is the only way that I am acquainted with by which you can ascertain the correct polariscopic test of sugar, where the sugars are taken at different temperatures.

Q. Have you made personal tests of sugar?

A. Yes.

Q. And what has been the result of your personal experiments and investigations as to the effect of temperature?

A. My personal investigations—but they were made many years ago, eight or ten years ago—the more elaborate ones showed that for the differences of temperature in our country of 10.5° C. that the error in the polariscopic reading for using chemically pure sugars was from .3 to .32 of one per cent. over the range, or approximately of .03 for each centigrade degree of difference from the normal temperature upwards through this limited range of temperature. These results confirmed experiments which I previously made in 1884 and 1885.

Q. What do you mean by "normal temperature"?

A. 17.5 is the normal temperature.

Q. At which the instrument is standardized?

A. At which the instrument is standardized.

Q. And whenever the temperature is above 17.5 does the temperature become a factor in arriving at the correct test?

A. If it is above 17.5 or if it is below the temperature must become a factor in arriving at the correct test.

Q. If it is above, what do you do?

A. If it is above, you would have to add to the polarization.

386 Q. How much?

A. I should add .03 for each centigrade degree that the instruments and solutions were above the normal temperature.

Q. If it was below 17.5?

A. We should substract the same; we should correct similarly by subtraction, but the figure of .03 is too high for the low temperatures.

Q. Do you know Dr. Wiley in your country?

A. Yes.

Q. What is his standing and reputation there?

A. We consider him to have a very high standing; we consider him to have the highest standing as a chemist dealing with sugar

and so on of any English speaking chemist. That is not alone my own personal opinion but also the opinions that have been mentioned to me by my colleagues in the West Indies.

Q. Is the polariscope a scientific instrument?

A. Yes.

Q. Have you read Dr. Wolfbauer's testimony given before the referee here in this case?

A. Yes, I have seen that.

Q. What have you to say in regard to his views on this subject as expressed in that testimony?

Objected to; objection overruled; exception.

A. I have practically said already much that he has said here with regard to the influence of the insoluble substance added or precipitated by the lead and in substances that may have optical rotatory powers on the absolutely scientifically correct determinations of sucrose. I don't agree with his expressions of opinion regarding Dr. Wiley's work.

Q. What have you to say as to his criticism of Dr. Wiley's method of measuring differences?

A. I have been through Dr. Wiley's paper with great care, and I cannot find these differences. I find differences that are lower and they are at once explainable; for instance, I notice, as I have done, that the differences have arisen from Dr. Wiley not only giving the results which he obtained with ordinary light, but also the results which he obtained with yellow light. Personally I may say I cannot get concordant results with yellow light; I never use it, yellow light, in the Ventzke instruments. And looking through this work it occurs to me that these differences which Mr. Wolfbauer has pointed out are due simply to Dr. Wiley having taken into consideration the results with the yellow-colored eye-piece, which I think, with due deference to Dr. Wiley, the majority of chemists in doing the work would have left out. They wouldn't have considered their results so absolutely fully as Dr. Wiley has done. I recalculated the results, omitting the results with the yellow eye-piece, and I found that, except in one series of determinations, these apparent differences disappear; and that in this one series I found the apparent differences are from 25 to 30 and from 30 to 35; the re-
387 sults would apparently show a difference between 25 and 30 of .19, and 30 to 35 of .15. There is evidently some unforeseen thing there, probably it may be some difference in the optical properties at those temperatures, or it may be some small error that would be corrected by further work. I think Dr. Wiley carefully pointed that out in his paper. By omitting the yellow light I find that his difference would read: from 10 to 15, .15; 15 to 20, .15; 20 to 25, .16; 25 to 30, .19; 30 to 35, .15; and 40, .20. But if we take the range from 25 to 35 in the mean that comes to .175; and in that way Dr. Wiley's figures would be in accordance with recognized physical laws. Of course we are perfectly aware that recognized physical laws are not always correct. But in questions of this sort I think they have seldom been gone into with the minuteness that Dr.

Wiley has gone into them here; and while to get these little differences away from our law that we have made—the best example of that is the fact that ice floats on water; it ought not to according to recognized physical laws and water ought not to expand from 4° to 0, as it does when it is cooling. Those are instances where nature has objected to the recognized law. And it may be that they are the same in these ranges for sugar and that it may be confirmed by further investigation, or that it may be shown to fall in line later.

The differences are due to Dr. Wiley having gone into this question more minutely that it has usually been done. In our way we would have taken a longer range and of course would not have recognized these differences.

Q. Isn't it true that physical constants vary at different rates of temperature?

A. Yes, we do find it in many places. We don't understand whether it is due to the physical constant varying, but we do find the variation. We don't understand in some cases whether it is actually the physical constant varying, or whether it is due to the fact that we are not perfect instruments of precision ourselves.

Q. What have you to say in regard to the illustration of Dr. Wiley's method mentioned in Dr. Wolfbauer's testimony?

A. I think it is an objectionable method for any man to criticise another man's work. It says: "These differences are certainly against all rules of variations in physical laws." That I have illustrated backwards by explaining the effect of heat upon water.

Q. With regard to his illustration of a man measuring a piece of cloth, what have you to say to that?

A. He says: "Suppose a man was measuring a piece of cloth and he found it, after making a series of measurements, to be a minimum 25 inches long and a maximum 52 inches, and then he would simply add up all his measures and find the average and call it a yard." That is the analogous case cited. I should have put it a little differently. I think I should say, suppose a man was measuring a growing boy who had attained a height of five feet six and a half, and he was ascertaining the rate at which he was growing
388 successive months, the accuracy of which, if Dr. Wiley had been doing that, would have been equal to an accuracy of one-thirtieth part of an inch. This leaves out the big measure and works up in a minute difference.

Cross-examination by Mr. TINGLE:

Q. Mr. Harrison, what is the object on the part of the Government in testing sugar in Demarara?

A. The only object that we have in testing sugar is where it is done on the request of the buyer and seller for them to settle their price upon.

Q. Does not the Government desire to obtain statistics as to the production of sugar?

A. No; the Government simply use their laboratory for any person who requires his sugar determined.

Q. Are all sugars that are bought and sold in Demarara bought and sold upon the test as thus ascertained?

A. That I couldn't say definitely. All those referred to us are.

Q. To what countries are those sugars sent that you refer to?

A. All sugars that we get are sent here.

Q. Are you not aware that the conditions of the purchase of sugar for the United States are dependent upon the test as ascertained in the United States on arrival?

A. I know nothing about that. I only speak about the conditions in which they purchase in British Guiana.

Q. You mean to say that American merchants purchase down there under those conditions?

A. They do, and they have for the last 18 years.

Q. And the purchase is not based upon the test here?

A. I don't know what they sell again upon; I suppose they sell upon their test here, because their test here would seldom be the same as the test there on account of the alterations that would take place in the sugars during the voyage.

Q. Naturally be higher, wouldn't it?

A. It would vary; in many cases it would be higher, especially if you had fermentation taking place in the glucose. Again, if the sugars contained certain fungi it might be lower; we have that as well; certain organisms actually attack the glucose and reduce it.

Q. What instruments do you use?

A. You mean my instruments? We use this Schmidt & Haensch shadow instrument.

Q. Have your experiments in testing sugar taken in the question as to the expansion of quartz plates?

A. We have taken into consideration the question as to the alteration in the rotatory power of the quartz plate.

Q. Due to what cause?

A. Due to the fact that as the temperature rises the rotatory power changes.

389 Q. In what direction?

A. The rotatory power will increase slightly in the quartz. That has been known for very many years.

Q. In arriving at your determinations, then did you take that into consideration?

A. In these we have taken everything into consideration. I have given you the correction as the correction covering the quartz, covering the alteration in the quartz, and the alteration in the rotatory power of the sugar.

Q. If I understood your statement, the rotatory power of the sugar solution varies to the extent of .3?

A. The two together, the rotatory power of the quartz increasing and the sugar solution diminishing, but the two together make this difference of .3.

Q. What is the difference as to the sugar solution itself?

A. The sugar solution—I have got here what I computed it to be at the time. The sugar solution is about .18, which is the change from our range of temperature.

Q. For each degree?

A. No, for the ten degrees. It would be about .018 for each degree.

Q. That is to say, it is that much lower?

A. It is that much lower than it would be at the lower temperature.

Q. How much does the quartz plate increase in the same degrees?

A. My determinations, I think, are .15 to .19.

Q. Then, if in one case the decrease is .18 and in the other the increase is .19, how do you arrive at the difference of .3?

A. They are both working the same way. If you have an increase in the quartz that will work in the same direction as the decrease in the sugar.

Q. You mean you add the two together?

A. No, they compensate.

Q. One balances the other?

A. No, they are additional.

Q. You add the two together?

A. You have got to add the two together.

Q. Although one is an increase and the other is a decrease?

A. One is the increase in one side and the other is a decrease the other way. I think it is explained in the paper that I read.

Q. How do you arrive at the decrease in the sugar solution?

A. We have arrived at the decrease in the solution solely by determining the angular rotations at the different temperatures.

Q. How do you determine the angular rotation?

A. By examining the solution in the sodium light instruments and measuring the angular degrees. That is the way we have determined it.

Q. The measurement is by the scale of the polariscope?

390 A. The measurement is by the scale of the angular degrees.

Q. On the polariscope?

A. On the Laurent instrument.

Q. How do you do it by the Schmidt & Haensch?

A. We should have the difference in the quartz we would get in the Schmidt & Haensch's. We should have to calculate out the effect of the quartz for the total effect.

Q. Then your answer awhile ago was based upon the results from the other instruments that you spoke of where you use the angular degree?

A. At first I used the instrument showing the angular degrees and there there was a correction; the maker's normal weight was 16.19; the normal weight we found necessary at 84 or 85 degrees at 28° C. was 16.3.

Q. Leaving out of question entirely that instrument that you speak of and taking into consideration the Schmidt & Haensch, which is used in your country and this country too, please tell us just how you arrive at those differences in the rotatory power of the sugar solution?

A. You would only arrive at that in that one by determining it at different temperatures and calculating out according to the dif-

ferent formulas that are given the effects of the quartz compensating part of the instrument; we have done it by determining the same sugars at the same time on the sodium light instruments and then polarizing them on the Schmidt & Haensch.

Q. You have used two instruments then?

A. In those determinations. I mentioned those we made nine or ten years ago. It is not anything less than what is going on now.

Q. How do you know that your instrument, the Laurent instrument, was correct.

A. I know the correctness from comparison with the standard quartz plates that we have had and from comparison with my other instrument.

Q. How do you test your Smith & Haensch instrument?

A. By weighing out first of all the normal weight for the normal temperature and polarizing that, using chemically pure sugar; that shows .3 too low We have done that again at higher temperatures and we have found that it showed still lower results. We can't get back to a low temperature in the tropics because the instruments get covered with moisture. Then we have determined they were due to the temperature changes by making the solutions of the normal weights of chemically pure sugar at the normal temperatures; by allowing this then to increase in volume to the temperature of the place, by taking the readings then, which, of course, are far lower than that, and by determining at the same time the rate of expansion of these liquids, take the specific gravity at the two temperatures.

391 Q. Is that method practicable for the ordinary sugar chemist in testing the sugars of commerce?

A. I am not speaking about that.

Q. I am asking you about that now. Is that a practicable method of testing sugar in the ordinary course of trade?

A. No; you would never have any time for your trade if you went into that sort of work.

Q. In the Treasury regulations, this last paragraph of that article: "For example: A sugar solution polarizes 80.5; the control plate just before had given a polarization of 91.4, the temperature of the room during both observations being 25° C. According to the table the value of the control plate at 25° C. is 91.7; the reading is therefore 0.3 too low, and 0.3 is added to the reading of the sugar solution, making the corrected result 80.8. The temperature of the room must be ascertained from a standardized thermometer placed close to the instrument and in such a position as to be subject to the same conditions."

Q. I understood you to state awhile ago that that method of polarization had been an example of how it was done for the purpose of obtaining a correct polariscopic test?

A. The correct polariscopic test, as far as you can get it correct.

Q. But is it the polariscopic test?

A. You mean of an absolutely accurate test of the sugar present?

Q. I mean is it the polariscopic test?

A. Yes, I should take that as the polariscopic test. With the quartz plate, it would depend on the accuracy of the standardization of the quartz plate.

Q. You mean to say that the polariscopic test is to be ascertained by something outside of the polariscope itself?

A. Yes, in this case. It is simply instead of ascertaining the correct normal weight for the polariscope at this temperature 25° and using the weight of sugar, you put in the correction by means of a standardized quartz plate. Of course the accuracy depends upon the accuracy of the standardization of your quartz plate. It is a simple way of working a difficult problem.

Q. But your understanding is that this is a correction of the polariscopic test?

A. That is the correction due to the change of temperature.

Q. Is it a correction of what the polariscope shows?

A. It is a true polariscopic test for that temperature.

Q. But the polariscopic test, according to the reading of the scale, is 80.5?

A. It would be that——

Q. It is that, isn't it?

A. No, it is not the true one; it would be that if the temperature were 17.05. But as your temperature varies your polariscope by itself ceases to be an instrument of accuracy. This is a
392 method by which your polariscope is brought back within the range of temperature and becomes an instrument of accuracy.

Q. In other words, you correct the polariscopic test?

A. No, I should not correct the polariscopic test; I should get the polariscopic test by correcting the instrument.

Q. You correct the polariscope, then?

A. We make it correct in this way.

Q. You change the report that the polariscope makes out?

A. No, I do not; I make the polariscope give a correct report.

Q. Does the polariscope give that report?

A. The polariscope does give that report when it has this correction applied to it. It doesn't matter whether you put on your quartz plate at one end, or whether you do as ninety-nine out of a hundred do with the polariscope—you must correct your zero point before you do your work. You will find that every man who does this work has to correct this instrument first for his own eye. If you don't adopt these corrections in my opinion polariscopic tests cease to be tests of accuracy for what is wanted: if you do adopt them you will get as close to accuracy as you can get for commercial purposes applied in this special way irrespective of the impurities in the sugar.

Q. Didn't you state awhile ago that the test even this way is not absolutely accurate?

A. That is what I state again, that irrespective of the impurities present in the sugar.

Q. It is generally understood in the trade in Demarara in the

British West Indies that this method that you say has been adopted there is used in the buying and selling of sugar?

A. Oh, yes; it has been well known there for many years.

Q. Are there private chemists there?

A. There is one.

Q. He uses the same method?

A. I believe he does now; he did not at one time; he used a peculiar one of his own.

Q. How long since he began using your method?

A. He only used his own method for about four months; but he has used our method at any rate for the last five or six years. There was a private chemist before that, who died about 1894, and he had been using the same method that we had the whole time that he had been praticing it; of course he was taught at the laboratory.

Q. You stated that where the temperature is above 17.5 it is necessary to add .3 for each 10 degrees?

A. Yes, .3.

Q. And if the temperature was below 17.5 it is necessary to subtract?

A. Yes.

Q. Is it ever below 17.5 in Demarara?

A. Of course it is not; it is never below 27.

Q. That never occurs as a matter of fact?

393 A. As a matter of fact our temperature is practically stationary, so it makes things simple for us.

Q. At what degree is it stationary?

A. It is seldom down to 27°; the laboratory is generally from 28 to 29°, and it is very seldom up to 30° in the laboratory; from 80 to 86° F.

Q. It is a pretty even temperature?

A. Oh, yes.

Q. Will you describe the methods by which you reached these conclusions as to the difference of .3.?

A. I said we did this by first preparing chemically pure sugars, and then by using the makers' standard weights for the different instruments at our temperatures; and in that case we found that as a rule in all cases there were variations; they would not read 100; they read on the Schmidt & Haensch instrument from 99.65 to 99.70.

Q. Did you make experiments similar to those that Dr. Wiley describes at different varying degrees of temperature?

A. Only at temperatures above 27°. We cannot get the temperature down without clouding the instruments; we have tried it. But I said I made it in a different way; we made the normal weights up to the normal volumes at the normal temperatures. Of course I can easily do that for a small thing. Then we allowed those to expand—to rise to the temperature of the laboratory; we determined the specific gravity at both those temperatures; that would give us the expansions. We found that the error in the polariscope was not compensated by the other due to the expansion and that it had this residuary error of .3. I think in these experiments it worked about

.28; I can't remember the exact figures now, it is so long ago since we did them.

Q. How did you get the temperature of your instrument, the temperature of the room, or where you did the work, down to the normal temperature?

A. I told you we cannot do that; that we have to use an indirect method; we cannot possibly do it; we should have the whole place and instruments wet; we have tried to do it but failed in that way; but we have taken it by determining the temperatures above 80 which we could do.

Q. Then you haven't any actual knowledge of the variation that you speak of except what was shown by your experiments at the regular temperature of 27° or whatever it was?

A. Yes, we have the actual knowledge, as I have told you, because of the experiments with the solutions made in different temperatures.

Q. I understood you to say that you couldn't make the solutions at different temperatures?

A. I said that I could make the solutions at any temperature, but I can't reduce the instruments to these very low temperatures so as to be able to use them satisfactorily.

394 Q. Then your solutions that you made up at different temperatures can't be polarized at the same temperatures they are made up?

A. No, we can't except the temperatures are above 80°. I mentioned that in my first examination. The accuracy of the instrument of course is repeatedly determined by the comparison with the standard quartz plates, some of which we get from Germany and some from France, which have been in use for very many years.

Q. Do you know the firms here of Elbers and P. Armstrong and John Farr, New York?

A. I don't know any of those.

Q. You don't know whether they buy sugar on the terms you speak of or not?

A. I know, for instance, the agents from Armstrong buy sugar on these terms; they are Booker Bros. & Co.; I do the whole of their work.

Redirect-examination by Mr. PLATT:

Q. Doctor, why can't you get the temperature down below 17.5?

A. I can't get the temperature below 28 or 27, because the dew point is so very high that if I reduced the temperature two or three degrees the instruments get all covered with moisture.

Q. So that it has been impracticable to make that experiment?

A. Yes.

Q. But you have made them at higher temperatures?

A. We have made them at higher temperatures.

Q. You have spoken about certain niceties in the polariscopic tests and all that, and that if they were made in every case there wouldn't be any time for trade?

A. If they were made in every case the chemists would make a better living.

Q. But the results of those investigations and repeated experiments become well known, don't they, among chemists?

A. Yes.

Q. And the results can be used in trade without repeated experiments, can't they, after once being ascertained?

A. Once being ascertained and confirmed.

Q. They can be applied?

A. They can be applied.

Q. Without any trouble?

A. Without any trouble, if done in Dr. Wiley's way.

Q. And the results would be substantially uniform?

A. They would be substantially uniform. They would be simply subject to the personal equation of the chemist.

Q. The difficulties about impurities of sugar apply to all commercial operations of sugar?

A. Yes; of course they vary with the kind of sugar and the quality.

395 Q. And those are universally met with?

A. I believe they are. The business people get rid of them, I fancy, by paying different prices.

Q. If different instruments were standardized at those different temperatures, then there wouldn't be any necessity for correction?

A. There wouldn't be any necessity for corrections. I mentioned that I determined these corrections not only on my own polariscope, but I think between thirty and forty that were used in the colony. The differences I determined on a large number of polariscopes in addition to my own.

Q. These shadow instruments are the same now as they were previously, no difference in the instrument?

A. I wouldn't like to state that definitely, because I think as far as my knowledge goes some of those earlier ones were standardized on a true cubic centimetre, while the later ones are graduated on the Mohr system; which won't affect the correction if they are used with their own normal weights and normal volumes.

Q. The results are the same?

A. The corrections would be the same if you used the correct flask for the instrument.

Recross-examination by Mr. TINGLE:

Q. Is there any law in Demarara or the British West Indies relating to the use of the polariscopic test in reference to the buying and selling of sugars?

A. No, there is no colonial law.

Q. It is simply then by the consent of trade?

A. It would be by consent of trade guided I suppose by the chemists' opinion.

Q. As I understand you, the sugar is bought and sold by the polariscopic test?

A. Yes.

Q. That is simply a commercial usage?
A. That is simply a commercial usage.

Dr. PETER T. AUSTIN, called as a witness on behalf of the United States, being duly sworn, testified as follows:

By Mr. PLATT:

Q. What is your occupation or profession, Doctor?
A. Chemist.
Q. And what experience have you had as such?
A. I was graduated in the class of 1872 at the Columbia College School of Mines; then went to Germany and studied three years there under Prof. Hoffmann, devoting myself to organic chemistry. Returning to this country I filled the chair of chemistry at Dartmouth college, afterwards at Rutgers and the New Jersey
396 scientific school, and later the Polytechnic institute at Brooklyn. I have been honored with membership in various chemical societies, including the Chemical Society of England, France, Russia, this country, and have been connected with various official boards, boards of health, public works and so on; and have been devoting my time and attention to the practice of analytical and applied chemistry; and I am familiar with the polariscope in the determination of sugar.

Q. Were you called on to make polariscopic tests of sugar in a practical way as an expert?

A. Yes; I was requested by the solicitor of the Treasury to determine by experiment whether the polariscope was affected in its readings by temperature; and with that end in view and in order to make a practical test—as my instructions were to make these tests under the conditions that existed in the practical analysis of sugars as carried on in the department—I selected a small room in the laboratory of the appraiser's stores, this city, known as the photographic room, in which the temperature could be controlled; and I obtained also a new triple shadow polariscope made by Schmidt & Haensch, and procured one of the balances used in the department and weights, flasks, tubes and other necessary apparatus. I obtained a sample of purified cane sugar and proceeded to make a set of polarizations to determine whether or not there was a variation in the readings at different temperatures. The first set of determinations I made on December 14 in this room, at which the temperature was 25.5° C., the thermometer being a very excellent one; the temperature remained constant at that temperature. I used in all of these determinations two flasks and two tubes only. I made four weighings of the sugar and made of each weighing two polarizations; and at this temperature (25.5° C.) I obtained as a mean 99.8 per cent. I made each reading twice, sometimes three times, so as to be perfectly sure that my eyes were in fairly good condition. Then on December 15th, the next day, I made another set of polarizations at a temperature of 36.5° C.; the temperature was increased by the use of electric stoves and fans, and by means of the door I found after some experimenting that I could keep the temperature constant; in

fact, it did not vary from 36.5° during the determinations. I made six weighings of the same sugar and polarized each sample, made two polarizations of each sample, that is two tubes, and of those twelve readings I got an average of 99.65 per cent. Then on the next day, December 16th, as the weather was cold, I placed the polariscope over night in what was known as the cold storage room of the department. The artificial cold was on, but the night was cold and by leaving the windows open over night I found a temperature in the room in the morning of 6.5° to 5°; that is to say, by opening the windows I could get 5° and by shutting them 6.5°. As the wind was blowing I could by manipulating one of the windows keep the temperature of the room at a constant of 6, which I did, so that these determinations were taken at 6° C. I weighed out again
397 the six samples and made of each two polarizations and obtained as an average 100.58. So that those are the results of the three sets of experiments which I made and which showed that working in what I consider are practical conditions of the sugar laboratory as existed at the appraiser's stores, there were these differences in the readings existing.

Q. In making the readings at the normal temperature, at 25.5°, how was your scale illuminated?

A. It was illuminated with an electric light which threw the light on the mirror, thence to the scale, and which I shut off between the readings. I should say that the light used was a kerosene student lamp.

Q. Doctor, what was the result of your practical experiments as to the effect of temperature on the polarization of sugar?

A. The results which I obtained showed that the polarization decreased as the temperature rose and increased as the temperature fell. Taking the difference of my readings, that is the difference between 100.58 and 99.65, I get a difference of .93, and dividing that by the total difference in temperature, 30.5°, I get a factor of .03049.

Q. You heard Dr. Harrison's testimony here?

A. I heard most of it; I didn't hear all of it.

Q. Do the tests that you made substantially agree with Dr. Harrison's?

A. They appear to, yes.

Q. And Dr. Wiley's paper, are you familiar with that?

A. Yes, in so far as my results check his. Of course there is a great deal of work that he did in his paper I did not repeat.

Q. But the practical result corresponded to that?

A. Yes.

Q. Did you polarize a quartz plate at the temperatures at which you polarized the sugars, and did you find that the polarization was the same at all temperatures?

A. Practically so, yes. I don't know that there was any appreciable variation.

Cross-examination by Mr. TINGLE:

Q. How did you prepare the solution that you used?

A. The sugar was weighed off in a German silver pan which was used in the department, using the balance weight and the weight representing the amount called for; that was dissolved with water, and poured into the flask and dissolved; then a small amount of the acetate of lead solution was added, agitated, filled to the mark, and filtered through a dry filter paper into the receptacle.

Q. Was this sugar that you used chemically pure sugar?

A. It was the solution used in the department, in use there; I did not make any examination of it.

398 Q. You don't know what the test or the actual sucrose content of that sugar was, do you?

A. You mean of the sugar that I used?

Q. Yes?

A. No, sir.

Q. Was it refined sugar or raw sugar?

A. It was a specimen of refined sugar which I obtained from Prof. Wiley and purported to have been made by the American Sugar Refining Company, a very beautiful specimen of sugar, and in every way appeared to be a pure sample; I did not make any chemical analysis of it.

Q. Your only knowledge then of the test of this sugar is that which you obtained by your own tests?

A. That is all. Of course I can put the sugar in evidence if desired; I have the balance of it.

Q. Did you weigh out the sugar each time that you made a test?

A. Yes; I made in the later cases six separate weighings and polarized two tubes full for each solution; so that in the last two experiments I made six separate weighings and in the first one four weighings.

Q. Did you make a stock solution, dissolve the sugar once for all, or did you dissolve each sample?

A. Each sample a separate weighing.

Q. Would you regard it as a correct method to make a stock solution and test sugars on different days of that particular solution?

A. Well, I think that would depend a great deal upon the person.

Q. Would you do business that way?

A. I wouldn't do it in a court case in that way, because I should want to take every possible precaution; but I think for practical work that a chemist who is accurate ought not to make an error in making the stock solution; of course it increases the possibility of error.

Q. Would you regard it as a chemical method to add mercury chloride for the purpose of preserving the solution?

A. I don't think that a small amount would produce any material difference, but my answer is not based upon experiment.

Q. But would you do it in that way as a professional chemist?

A. I couldn't answer the question, because the answer would have to be based upon actual experience with the substance, and I have not made any experimental study of it. I would say off-hand

as a matter of opinion that I don't think a small amount would produce any appreciable effect; it is simply hearsay and not knowledge based on my own experience.

Q. If I understand, this sugar that you used was refined sugar and was practically chemically pure sugar?

A. I think so with the exception of difference in a slight amount of moisture.

Q. Then do you regard it as a legitimate method of testing to add a foreign substance to that?

399 A. If a foreign substance does not in any way affect the polarization I see no objection to it.

Q. You do that, don't you?

A. Yes; I add a small amount of basic acetate of lead; I add a small amount in every case.

Q. Why do you make that addition?

A. Because it was a part of the method used at the appraiser's stores, and I wished to make these experiments under the conditions of their laboratory, so I added a small amount of the basic acetate of lead, although my solution was practically clear enough to polarize without it.

Q. Is that the method used at the appraiser's stores in testing chemically pure sugar or refined sugar?

A. I think they do it always; it is my impression that they treat every sugar precisely the same as regards that.

Q. In making your experiment do you use any formula of Jobins or any other for the purpose of correcting the effect of the temperature on the quartz wedge?

A. No, I make no corrections whatsoever. The question, as I unstand it, that was put to me, was to simply determine by experiment whether there was any variation produced in the practical polarizing of a fairly pure sugar under the conditions of the ordinary laboratory. I did not make any corrections of any kind, nor did I investigate the causes of the variations in polarizing.

Q. The results that you got then were the actual tests given by the polariscope?

A. Yes; the exact readings that I obtained.

Redirect-examination by Mr. PLATT:

Q. Any one read with you?

A. Yes. I might say that I checked my readings for several days against Mr. Chapman, who is the polarizer there; and at these various meetings or these various experiments Mr. Chapman, and my assistant, Mr. Maywald, and Prof. Wiley all read the polariscope, so that I had their readings as well as my own, and we agreed very closely. While the slight difference in personal factors can occur in all these determinations, Mr. Chapman and I read almost exactly the same. I worked with him some time and first on the instruments that were at the department, the two shadow instruments, Schmidt & Haensch, and later with this new triple Field; so that my results were checked almost exactly by Mr. Chapman in every case.

Q. In all these tests at these different temperatures did you use the same flasks and tubes?

A. Yes; I have already stated that I only used two flasks and two tubes, and observed all the precautions that I could as to exactness and regulation.

400 Q. Yours was simply a polariscopic reading without any corrections.

A. Made no correction whatsoever?

Q. And the same sugar at different temperatures read a difference of about one degree?

A. Yes, about that: .93.

Adjourned without fixing date.

United States Circuit Court, Southern District of New York.

No. 2918.

BARTAM BROS.
vs.
THE UNITED STATES.

No. 2919.

BENJAMIN H. HOWELL, SON & CO.
vs.
SAME.

No. 2920.

THE AMERICAN SUGAR REFINING CO.
vs.
SAME.

Hearing resumed March 22, 1900.

Before Hon. William B. Howell, as officer of the court.

Appearances.

For the importers: H. B. Closson and A. K. Tingle.
For the United States: Henry C. Platt, ass't U. S. Attorney.

HENRY MORTON called as witness on behalf of the United States, being duly sworn, testified as follows:

By Mr. PLATT:

Q. Professor, what is your profession?

A. I am president of the Stevens Institute of Technology in Hoboken, New Jersey; and have given special attention to the subject of chemistry. Prior to 1870, when I accepted my present

position, I was professor of chemistry in the University of Pennsylvania in Philadelphia.

Q. In the line of your profession have you had occasion to know the polariscope?

A. I have. I have used it from time to time during thirty years and have given instruction in its use in lecturing to classes.

Q. Have you examined into or had any experience in testing of sugars by the polariscope?

A. I have, during the series of years in various connec-
401 tions; not as a commercial sugar chemist, but chiefly in researches, scientific researches.

Q. Have you recently made any such investigations in that line?

A. I have.

Q. How recently?

A. During the last few months; I can get the exact dates; it was beginning with January of this year.

Q. Have you found in your experience and investigation that the temperature exerts any influence upon the polarization of the sugar solution?

A. I have.

Q. Now, will you please to state the results of your experience and investigation in that respect?

A. Broadly the results are to indicate or show that a rise in temperature of one degree centigrade produces a reduction in the apparent polarization, polarizing effect, of .03 of one per cent. Do you wish me to state the experiments in detail?

Q. Yes, I was going to ask you to give the practical results of any experiments you made in that direction?

A. For example, on January 31st, in the morning the temperature of the room in which the work was done and the experiments made being at 5° C., I made readings upon a solution prepared in the regular way of what I believed to be pure sugar. These readings showed, taking five successive ones,—100.4, 100.4, 100.5, 100.4, 100.4,— making an average of 100.42, which, corrected for the flask used to measure the quantity of solution, gave 100.34. Then on the same day in the afternoon, in a room whose temperature was 32.5° C. a solution of the same sugar made up in exactly the same way, gave five readings which were identical, that is, each reading was 99.6, making of course an average of 99.6; with the same correction for the flask this gave 99.52. Now the difference between the two temperatures, namely, 32.5° C. and 5° C. was 27.5° C.; and the difference between the readings of 100.34 and 99.52 was 0.82; dividing this number by the number of degrees gives us 0.0298, which obviously is almost exactly .03 per degree. In other words it is .002 less than .03. Such an error or such a difference is of course insignificant and within the usual limits of error in such observations. This result was confirmed by others made previously, and also in accordance with the literature of the subject, I should say the recent literature of the subject, in which the researches of

various chemists abroad and in this country have shown they substantially——

Objected to.

Q. Do the results of your experiments correspond with the researches of other scientific men here and abroad in the same direction?

A. They do.

402 Q. Did any one assist you in making the readings? Any one read with you during these experiments?

A. Dr. Harwood Huntington of New York was with me and assisted and made independent readings.

Q. What polariscope was used?

A. The polariscope that was used was one of Schmidt & Haensch's with the double wedge adjustment; otherwise this instrument is often called half tone.

Cross-examination by Mr. CLOSSON:

Q. Is this instrument what is known as a polariscope or a saccharimeter?

A. Both names are applied, but, of course, it is strictly a saccharimeter, but a polariscopic saccharimeter; there are other kinds of saccharimeters.

Q. But it is technically known as a saccharimeter?

A. Both are technically used; some chemists talk about it as a polariscope and another man would talk about it as a saccharimeter; but it is a saccharimeter operating upon the principles of a polariscope.

Q. Is it a double quartz wedge?

A. Yes, double quartz wedge.

Q. Is it a triple field instrument?

A. No, it is what is called a half tone.

Q. The discs being of different colors?

A. Different shades, and uniformity when the rotatory power of the material measured is balanced by the movement of the quartz.

Q. Was there any special reason for your using these two temperatures?

A. Simple convenience. I left the windows open all night and found that temperature in the morning 5° C., and then during the day I closed the room and reached this temperature and found that it was maintained in the room. For half an hour or so just before I began to make the measurement——

Q. At what hour of the day was the first reading taken, at the first temperature?

A. It was taken in the morning, probably about ten o'clock; I don't remember the exact time; about ten o'clock in the morning.

Q. On the 31st of January?

A. On the 31st of January.

Q. That being approximately the outside temperature of the room?

A. No doubt a little higher than outside temperature.

Q. And about how many hours later was the reading taken at the other temperature?

A. That was taken towards the evening; I should think about six o'clock.

403 Q. With an interval of about eight hours?

A. Yes.

Q. The instrument had remained in the room during the whole time?

A. Yes.

Q. Had there been any change in its position?

A. Yes; in fact the instrument was first used in the morning in a room connected with the institute building, and in the afternoon in my own private laboratory connected with my house, as I could heat that room hotter than I could the other.

Q. I understood that all the readings were taken in the same room?

A. No. The instrument was moved from the one room to the other.

Q. When was it moved?

A. Shortly after the first reading and remained in the other room while the room was getting heated up.

Q. And the temperature which on the Fahrenheit scale is approximately 90°?

A. About.

Q. Were the readings made of the same solution or did you prepare a separate solution?

A. I prepared a separate solution.

Q. When did you prepare the solution that you first read?

A. Shortly before reading it; in other words, I probably began it nine o'clock and by the time the solution was prepared it was placed in the instrument and read, so that the preparation could all be done at the temperature.

Q. And the second solution was prepared in the other room?

A. In the other room and in the same way.

Q. How long before you used it?

A. The conclusion of the preparation was perhaps between half an hour or a quarter of an hour before the actual reading; simply a time to place it in the instrument and get everything adjusted.

Q. State exactly what the preparation consisted of?

A. Weighing out the quantity of sugar, dissolving it in water, making up the solution to the proper volume, noting the temperature of the solution, as well as the surrounding space, and then pouring the solution into the tube of the saccharimeter.

Q. Do you say you noted the temperature of the solution in each case?

A. Yes, watched the temperature of the solution.

Q. Can you give it?

A. I have not made a note of it, because it was the temperature at which the reading was made; that is the temperature of the solution is this temperature.

Q. You remember that?

A. Yes, I remember that it was as recorded.

Q. Are those the only experiments of the kind that you
404 have conducted with the view of ascertaining whether or not there is this difference of .03 per degree?

A. Those are the only ones that I conducted myself personally with great care so as to determine this exact figure; I have made many others with less care which indicated substantially the same thing.

Q. But you made no other readings at other temperatures than those two of which you have testified in connection with these experiments?

A. No, I made no other in connection with those experiments.

Q. What flask did you use?

A. What is known as the Mohr flask. It is simply a small graduated glass flask, that is, a flask of a certain capacity marked on its neck.

Q. What is the correction which you spoke of?

A. It was the subtraction of .08.

Q. Will you explain your authority or your reason for making that correction?

A. On account of the fact that the flask being carefully tested was in error in that proportion; it did not contain exactly one hundred cubic centimeters and therefore the solution was stronger by that .08 of one per cent.

Q. Is the Mohr flask supposed to contain exactly one hundred cubic centimeters?

A. Not at all; but this flask did not.

Q. Will you state at what temperature the Mohr flask is supposed to contain one hundred cubic centimeters of water?

A. My recollection is at 60° F.

Q. And the equivalent of that in centigrade is approximately?

A. 17.5°.

Q. Do you understand that the saccharimeter is standardized at a certain temperature?

A. Undoubtedly.

Q. And what that temperature is?

A. 17.5°.

Q. The same temperaure?

A. The same temperature, yes.

Q. What is Jobin's formula?

A. I do not recollect it.

Q. Did you use it in your experiments?

A. No.

Q. Will you state who are the other scientific men abroad and what papers or books of theirs you referred to in your direct examination in stating views corresponding with others?

A. For example, Petrucci and Sachs.

Q. Will you give the names of any essays or works that you recollect?

A. I have not got those with me, except in a pamphlet,
405 from which I could give the references; in other words I don't carry the references of course in my mind. Dr. Wiley's paper, for example, contains them all.

Q. Is it the work of Petrucci and Sachs cited by Prof. Wiley, taken from the Bulletin of the Association of Belgium Chemists?

A. It is.

Q. Can you enumerate any others?

A. Then the work of Wartze.

Q. In an article published in 1889 concerning the differences in polarization, page 503?

A. Yes.

Q. Any others?

A. Dr. Andrews.

Q. Articles by him in the Technology Quarterly in the issue of May, 1899?

A. Yes, sir.

Q. Are there some others?

A. There are some others, but I can't recollect the names at this moment.

Q. There are two articles by Mr. Andrews in that quarterly; do you refer to both of them?

A. Yes.

Q. What did you refer to in your testimony as the usual limit of error? What do you consider to be the usual limit of error in observations of this kind?

A. I should consider any error in the third place of decimals as negligible.

Q. You have never acted in any sense as a trade chemist, I suppose?

A. No, sir; I have not. I have acted as expert in a number of cases involving sugar.

Q. But you do not for the trade make polariscopic and saccharimetric readings?

A. No, I do not.

Q. You have made polariscopic or saccharimetric readings of raw sugars?

A. Yes, frequently.

Q. Will you describe briefly the process which you observed in making those readings?

A. In that case the proper quantity is weighed out, dissolved in water. Where the sugar is of dark color, which is of course usual in raw sugars, acetate of lead is added and sometimes animal charcoal for removing the color.

Q. And the effect is what, the addition of that?

A. The effect is to remove the color.

Q. By what way?

A. The acetate of lead precipitates basic acetate, carrying the coloring matter with it; and the animal charcoal has the
406 specific power of absorbing coloring matters of a certain character and removing them from the solution.

Q. And the result there is a precipitate at the bottom of the flask?

A. The result would be a precipitate on the filter; in other words, the acetate of lead is mixed and shaken up, and the bone black or animal charcoal is sometimes added and shaken up, and the whole thrown upon the filter paper, so that whatever precipitate is formed remains on the paper that the liquid runs through.

Q. Did you add this acetate of lead before you filled the solution up to the graduated point on the flask?

A. Yes.

Q. And then what did you do to bring the contents up to that mark?

A. Well, it isn't necessary; in other words, whatever you remove of the solution makes us so much less to subsequently deal with; but as the quantity you have prepared is much more than enough to fill the tube that is immaterial; in other words, one could throw away part of the material.

Q. Will you kindly state again whether or not this precipitate is formed in the solution contained in the flask before you fill up the flask to the mark which it contains?

A. In the sense that the chemical reaction takes place in the flask, that is correct.

Redirect-examination by Mr. PLATT:

Q. But it is eliminated by the filter?

A. Yes.

Q. In regard to this Mohr flask, doesn't it contain one hundred grammes at 17.5°?

A. Yes.

Q. You said cubic centimetres?

A. They are the same thing; a cubic centimeter of water is a gramme.

Q. Same thing?

A. Same thing.

Q. And its volume at 17.5° is 100.23, isn't it?

A. I don't recollect that at this moment; my impression was that it was a hundred.

Q. Well, it is a hundred anyhow?

A. Yes, substantially a hundred.

O. H. TITTMANN, called as a witness on behalf of the United States, being duly sworn, testified as follows:

By Mr. PLATT:

Q. Professor, what is your profession and position at the present time?

A. I am an engineer by profession and my position is that of Assistant Superintendent of the Coast Survey.

407 Q. What experience, if any, have you had with the polariscope, Professor?

A. None excepting in the line of duty in regard to special observations with which I was entrusted.

Q. Those duties cover the polarization of sugars?
A. Yes sir.
Q. And when were you called upon to investigate that subject?
A. First in 1890?
Q. And for what purpose?
A. For the purpose of testing the weights and flasks and tubes and plates used in various laboratories in the custom houses.
Q. What was the result of your investigation?
A. Is it worth while to speak of the length of the tube- and flasks?
Q. Give the general results?
A. What I think was the most important result was when I made polarizations of pure sugar at different temperatures I found a decided difference in the polarization.
Q. How many actual experiments did you make in that respect, about?
A. I refer now to the experiments that I made in 1890—I say 1890, I think they were made in December, 1890; I am not quite sure; they might possibly have gone over into the next year, because it was about the end of December, but I believe I am quite right in regard to that. The observations were made I think on about ten days, that is extending over ten days; and on each day I polarized some sugars. I used three instruments successively and took readings on them. That describes it as nearly as I can tell you the facts.
Q. And were there similar results in each case as to the difference in temperature?
A. Yes.
Q. Have you made any experiments since that time?
A. Yes, sir; I made some more not very long ago; that is, in November, last November.
Q. What were the results of those latter experiments?
A. They confirmed the previous ones.
Q. Are you able to state as the results of those experiments and from your investigation of the subject what if any allowance for temperature you found should be made in order to equalize the polarization?

Objected to.

Q. What was the result of your investigation in regard to the difference in temperature?
A. It was that a correction of about .03 of a degree Ventzke has to be made.
Q. What instruments did you use?
408 A. Do you refer to the first or to the last?
Q. The last experiments?
A. In the last one we used the triple field instrument.
Q. And in the first experiments?
A. In the first I used two color instruments and a half shade.

Cross-examination by Mr. CLOSSON:

Q. Are you able to give in more detail than you have done in your direct-examination the results obtained in the different experiments? You have given only the general conclusion; I would like to know the data from which you draw those conclusions?

A. I can to a certain extent; I didn't bring any figures.

Q. Have you no notes here or memoranda to aid you?

A. None; but I think I can rely upon my memory.

Q. Be as full as you can?

A. Would you like to have me talk about——

Q. I want you to give such details of those experiments as you can?

A. Then in regard to the first experiments I took some pure sugar and made it up in the customary flask.

Q. Which is that—the Mohr flask?

A. At that time the flasks that I had—I remember in the first one I used quite a number; they were large; they were more like the Mohr flask than the true flask; I have one in mind because I remember especially its value was about 100.26, very near the Mohr flask. And I had the water and the sugar and the instrument in one room.

Q. Throughout the whole ten days?

A. No; I am speaking now merely of one circumstance. And the temperature of the room about the time when I made the first reading was about 17.5° or a little lower; it varied several degrees in the course of a few days. After making up the solution I polarized the sugar, taking some precautions, that is, I had the tubes carefully wrapped and the light separated from the polariscope, my object being of course to have as constant a temperature as I could preserve. Having made a number of observations in that way I think then the matters remained in the same room and I awaited changes of temperature.

Q. Through natural causes?

A. Through natural causes, yes. Just the sequence of that I do not remember; but after getting a higher range, say in the 20's, I took the whole apparatus, that is, the three polariscopes and the tubes and the distilled water and the sugar into an adjoining room.

Q. Over how long a period of time did these experiments continue?

A. I was not definite in regard to that, because I am not quite sure. The whole experiments I think covered ten days.

Q. Is it your recollection that the temperature of the room was constant?

409 A. No, not entirely constant. It was constant during a day, say. If there were great changes outside the changes would make themselves felt slightly in the room.

Q. Was the room artifically heated?

A. I think it was; yes, considering the month.

Q. Do you remember the month?

A. As I said, they were made in December.

Q. And at times the room was opened to the outside air and at other times the outside air was excluded?

A. I think that was about the temperature of the room, 17.5°, in that neighborhood; and probably when the heat was not turned on; I am unable to answer that now.

Q. And you can't give in detail the different readings that you then obtained?

A. No; I can tell you, though, what the equivalent of them was, and it would be quite accurate; after I finish my story it would be involved in the statement to your satisfaction. I would call these observations that we made in that room low temperature observations. I then took, as I was proceeding to say before, the flasks, tubes and the sugar and the water into an adjoining room which was artificially heated and which in fact was very warm; it is especially arranged for constant temperature, because there is a dividingengine in it and an apparatus which is used for graduating circles, and there the temperature is kept constant or was at that time. So I removed the apparatus into that room and the balances, and after waiting a day or so I began observations there, making all my solutions in the room, and the temperature that I got there was in the 30's, I think; it may have been a degree or so below, but I think it was up as high as 32; I believe that is about the extreme limit. Now, having made observations there several days in that room I again went back to the first room so as to verify my first observations; and leaving the instruments in that room for a suitable time—I don't mean on the same day, I mean leaving them there for quite a long time, until I felt satisfied that everything was about the same temperature—I repeated my first polarizations and got the same results. Now, the actual value that I deduced from those observations, that is, the coefficient of which I have been talking here, was .029 and a fraction, so that it matters very little about the particular reading if you apply that, as I had a long series of observations; that would represent of course the best value that could be deduced from those observations so that if you were to ask me, for instance, what the particular reading at 17.5° would have been I cannot answer that, but I could say to you that at any observed temperature above that it would have been what I gave you, that is, added to or subtracted from according to whether the temperature was above or below.

Q. Am I correct in supposing and understanding that these experiments were conducted for the most part at only two different temperatures, the one the temperature of the first room,
410 which you stated, I think, about constant at 17.5° and the temperature of the other room which was about constant at 30?

A. As a matter of fact the temperature extended from about 15 to about 32; and there were temperatures in the 20's and in the 30's; there were quite a number of different temperatures. You do not recollect that in my testimony a little while ago, where I said in my cold room temperature that the temperature varied in that.

Q. Yes, I do, but I understood that was a very slight variation;

I understood it remained 17.5° during a day, but that during successive days the change was greater. Can you recollect any temperature at which you took observations in that room other than 17.5?

A. Yes, I can recollect 15—I won't give an exact figure—but 22 and 25, I had temperatures of 27, but whether I had these in the first room or the second room I am unable to say now.

Q. How often did you prepare fresh solutions during those experiments?

A. Every time that I made a polarization, that is, I call a polarization now a tube read successively on three different instruments.

Q. And a separate solution was prepared for each of those readings, a new solution?

A. I made a new solution every time that I made a set of observations.

Q. And as I understand you, your recollection of the results obtained is that there was a difference in the readings at those different temperatures corresponding to about .03 for each degree of centigrade?

A. Yes, sir.

Q. How did you obtain the readings which you say differed in this way? Were they readings which the instruments actually indicated or did you make some corrections in order to obtain what you consider to be the true reading?

A. They were referred always to the quartz plate.

Q. Will you explain a little more fully what you mean by that?

A. I would, before polarizing the sugar solution, I would read or take the reading of the instrument by a quartz plate; then I put in the sugar solution and read that; that gave a certain difference, might give a difference.

Q. I understand that the instrument indicated a certain reading, say 99.6; is that the reading which you compared with another reading at a different temperature and found it varied from it in the proportion to which you have testified, or did you take that reading of 99.6 and in some way correct that before obtaining what you considered to be the true reading?

A. What I practically did was to take the reading of the quartz plate; then I took the reading of the sugar solution. Assume that they gave a difference, that is, that the two readings were different;
411 at one temperature I would get a particular difference; at another temperature I would get not the same difference but a larger difference.

Q. What in each case do you in your mind attribute the difference which you found?

A. I attribute it to a change in the rotation of the sugar solution.

Q. And to that only?

A. Yes.

The WITNESS: May I modify that answer to a certain extent?

Mr. CLOSSON: Yes.

The WITNESS: I want to answer that by saying that I attribute it in the main to a change in the sugar solution.

Q. What else do you attribute it to?

A. The supposition that it is due entirely to the sugar solution is based on the supposition that the instrument, quartz plate and everything is at a uniform temperature; so there is a possibility of a very slight change due to some other cause.

Q. But the quartz plate was not at the same temperature, but at one time was 17.5° and at another time——

A. I mean merely at the time that the observation is made everything should be at the same temperature at the time.

Q. Did you not at one time make to the department a report upon the influence of temperature upon polarizing instruments and the effects?

A. Not exactly in that sense, no; I made a report of an examination of standards in custom houses and also reported what I have just told you personally; but it was not a special report on the effect of temperature, that was not the object of the report.

Q. What exactly was the object of the report?

A. To report to what extent there was uniformity in the lengths of the tubes, and in the flasks, and in the quartz plates, used at the laboratories.

Q. But not upon the effect of temperature upon these instruments in the different parts of the country?

A. Upon the instruments, no.

Q. Or upon the quartz itself?

A. The report contained all about what I have told you about the experiments that I made at that time.

Q. It contains in more detail the history of the experiments?

A. Not, perhaps, of the history of them, but the results are given in greater detail.

Q. Is that on file at the department?

A. I really don't know. It was a report that I made to the superintendent of the Coast Survey. I imagine it was referred to the department; it must have gone there.

Q. At about what time?

A. I don't know the date of it, but I think it was in December, 1890, or January, 1891, I don't know exactly.

412 Mr. CLOSSON: We ask the counsel for the Government to produce that report at a future hearing.

CHARLES A. CRAMPTON, called as a witness on behalf of the United States, being duly sworn, testified as follows:

By Mr. PLATT:

Q. Doctor, what is your profession?

A. I am a chemist.

Q. And where located?

A. In the Treasury Department: chemist to the office of internal revenue, Treasury Department.

Q. Are you familiar with the polariscope?

A. Yes, sir.

Q. And have been for how long?

A. For 17 years—20 years, I would say.

Q. Have you recently made any experiments with the polariscope in the testing of sugar?

A. I have.

Q. About when?

A. About November; in the month of November, 1899.

Q. Now, Doctor, will you give us the results and the methods of the experiments made?

A. The experiments were made in conjunction with Mr. Tittmann and Mr. Braid, of the Coast Survey, to determine as nearly as possible the effect of temperature upon the polarization of sugars; and they were made in rooms belonging to the Coast Survey, by the use of instruments belonging to them, with apparatus and instruments belonging to that office. The same sugar was used in all the experiments. The work was performed in conjunction, but each person making up the solutions, weighing out the sugar, making up the solutions, and taking the reading of the instruments. The results in general of these experiments was to show a difference of .03 of a degree for each degree centigrade variation in temperature.

Q. At about how many different temperatures were those experiments made?

A. Those experiments were made in two series, one series at low temperatures and the other series at high temperatures, the object being to obtain a range of temperatures, a considerable range, in order to show the amount of variation produced by the temperature.

Q. And did these results concur in all cases according to the temperature?

A. These results were in the main the results of these experiments—you mean as to the different persons concerned, or as to the results themselves?

Q. As to the results themselves?

A. As to the results themselves there was only one result, it might be said, unless details are taken into account. The result
413 was obtained by means of averaging what might be called two results, the grand average of the results at low temperature as compared with the grand average of the results at high temperatures. These two results being compared and being then calculated into the total range of temperature, give this figure which I have placed at .03 for each degree centigrade.

Q. Now, will you state the results of your own particular work, the particular work that you personally did there?

A. Can I look for that purpose at the notes that I have in a book?

Q. Certainly?

A. I have here my own individual notes made during the progress of those experiments and I have also the tabulation of the entire work, giving the results not only of myself, but of each of the other observers. I can give from this my own results for each polarization.

Q. Go on giving your testimony, using your notes to refresh your memory?

Mr. CLOSSON: I object to the witness referring to papers which are not offered in evidence, no objection being made to the offer in evidence of the papers themselves.

The WITNESS: The results of my individual work, the total result is a co-efficient of the change produced by the temperature in the reading of a sugar solution of .029 for each degree of centigrade, the correction being, as is understood, applied as a plus correction for temperatures above 17.5, and as a subtraction, as a minus correction, for temperatures below that point.

Q. This covers the whole range of experiments, this sheet?

A. It covers not each reading; it covers the mean of the readings of the instrument for each solution, independent solution, made up.

Q. The temperatures are given here?

A. The temperatures are given in each case.

Mr. PLATT: I offer that paper in evidence.

Mr. CLOSSON: I object to that paper being received in evidence unless it is accompanied by the offer of the original notes of which it is a tabulation.

Objected overruled. Mr. Closson excepts.

Said paper marked Exhibit G.

The WITNESS: I may state as an understanding all around that this tabulation I have compared with my original notes, so far as my personal work is concerned; the results given here as my personal readings I have compared those with my observations in these notes and I found them to be correct.

Q. You don't mean to say that that tabulated statement is a copy of your original notes only so far as it covers your individual work?

A. Only so far as it covers my individual work.

414 Q. That tabulated statement that has just been marked in evidence contains something else besides your individual work?

A. Yes, sir.

Q. Where did you obtain that Exhibit G? Where did you get the statements there other than your own individual work? Where are they taken from?

A. My understanding is that they are taken from the work of the other observers as marked on the tabulation.

Q. Who were the others that made this?

A. Mr. Tittmann and Mr. Braid.

Q. Mr. Braid, Mr. Tittmann and yourself made this together?

A. Made these in conjunction.

Mr. PLATT: Inasmuch as it appears that this paper, Exhibit G, contains something more than the witness' individual work, I withdraw the same from evidence.

Mr. CLOSSON: I object to its being withdrawn from evidence.

Mr. PLATT: I understood when I offered it in evidence that it was all the results of this gentleman's work, but it seems there is something else on there.

The REFEREE: It seems to have been offered under a misapprehension. I overruled the objection of the counsel to its going in, and as it is in the record and marked as an exhibit it seems to me that it should be left there.

Cross-examination by Mr. TINGLE:

Q. Professor, you stated that you made these readings at various temperatures and that this paper (Exhibit G) shows the result of those readings?

A. Yes, sir.

Q. Does this show the actual readings of each solution or an average of readings of several solutions?

A. The reading of each solution is the average of the different settings of the instrument on that solution.

Q. By "different settings" do you mean the settings made by each of your co-observers?

A. Yes; that is, each is given there under their proper initial. I am speaking now, of course, only as to my own.

Q. In the first item, No. 16, you have a reading of 99.84; does that 99.84 represent your reading of that solution?

A. Let me get the right solution.

Q. No. 1 C.

A. That is a mean of my settings of the instrument on that solution.

Q. How many settings did you make?

A. I made five settings.

Q. You made five observations of the same solution?

A. Yes, sir.

Q. At different times?

415 A. At the same time.

Q. One after the other?

A. One after the other.

Q. Well, now, what was the result of each of those observations?

A. 99.85, 99.80, 99.85, 99.90, 99.80.

Q. How do you account for those differences in the reading?

A. The difference in the setting of the instrument.

Q. Please explain what you mean by that?

A. The instrument—it is necessary to set the instrument a number of times and take the mean of the readings, because a person reading an instrument consecutively upon the same solution doesn't get always the same result.

Q. Tell me what you mean by setting the instrument?

A. I mean the movement of the thumb screw which moves the compensating wedges of quartz in such a way as to produce uniformity of the field of the instrument.

Q. After you make one observation, then you take out the tube, then put it back and make another observation?

A. That is right except that I do not take out the tube.

Q. If you read the solution the first time, the first reading you make, and you find that the disc is uniform, and you find it is 99.84

or whatever you may find it, won't it remain that way when you go to read it the second time without taking out the tube?

A. No; the reading the second time is obtained by throwing the thumb screw off that position and making the setting again, another observation.

Q. You make a reading then first, then you throw it out of gear, then you gear it up, screw it up to the proper point, then you make another reading and you find that differs from the first one?

A. Yes, sometimes; not always; sometimes it is coincident.

Q. In the matter that you read to us there, they were all different, weren't they?

A. They were the same in two cases, in four cases; that is, one setting was .85 and another setting .85; one setting was .80 and another .80, and another was .90.

Q. How do you account for those differences?

A. Simply because the instrument cannot be read with absolute accuracy every time. Any one who makes a polarization knows that is the standard and universal method of using the instrument.

Q. In making those experiments did you not use the precise method and formula which Dr. Wiley employed and to which he testified at the original hearing before the board of general appraisers?

A. I don't know that it is the precise method; I wouldn't be able to say. I might say especially as to all details, I could probably say that in general it is probably about the same. I can only make a general statement, because otherwise I would have to ex-
416 amine the details of the method which he used, which I am not able to do; it is something which has passed out of my recollection.

Q. Suppose you state the details of the method you used?

A. You want all the details?

Q. Yes.

A. It is impossible for me to be minute absolutely as to all details; that is simply an impossibility at this time. I can testify only of the details which were of sufficient magnitude and importance for me to make a note of them in the notes of the work that I have.

Q. Don't you remember the successive steps that you took in making those observations?

A. Yes, in general.

Q. State them as nearly and as specifically as you can?

A. The procedure as to the polarization of the sugar was the ordinary procedure in the use of the polariscope. In quantity the sugar was weighed out, the normal quantity for the instrument; it was dissolved in water and made up to the mark and polarized in the instrument. As to details of each step I would have to be very careful as to that. That is bound to be a more or less general statement of the method that was followed. As to particular points, as to particular details, if you will ask me each one——

Q. What was the character of the sugar that you used?

A. The sugar that I used was a sugar obtained from the custom house officials; it came from Mr. Jacobs originally.

Q. What was the character of it?

A. It was granulated; in its trade designation is was a dry granulated sugar.

Q. Did you find anything in this sugar besides the ordinary ingredients of granulated sugar?

A. I didn't make any special search for other constituents present, but I found nothing in the handling of the sugar to indicate that it was other than ordinary granulated sugar.

Q. You don't know the nationality of it?

A. No.

Q. Was this solution of sugar analyzed, chemically analyzed, to ascertain its exact saccharine strength?

A. Only so far as its polarization constitutes an exact chemical analysis.

Q. Does it constitute it?

A. I think so. I don't know how you can get any nearer to it than by polarizing it under very carefully regulated conditions. I know of no way by which a sugar, a dry granulated sugar, can be examined as to its constitution except by careful polarimetric examination. I might modify that by saying that an ultimate organic analysis might throw some light upon it, but such a method of examination is very unusual.

Q. Might there not be glucose in the sample of that sugar?

A. By that you mean the commercial article glucose?

417 Q. I mean invert sugar.

A. Well, I should say not.

Q. No invert sugar in a sample of dry granulated sugar?

A. Unless the quantity were exceedingly small.

Q. Might there not be raffinose in such a sample?

A. That is a possibility, yes.

Q. Did you test the sample in any instance for raffinose?

A. No, I did not.

Q. Did you test it for invert sugar?

A. Only so far as this operation of polarization which was conducted was to some extent a test for invert sugar. Upon that I based my answer a short time ago as to the presence of invert sugar.

Q. How do you know then that this sugar did not contain raffinose which would give you a result of over 100 per cent. in case it was present?

A. The sugar was reported to me as being a cane sugar, and so far as I know up to the present time there has been no instance on record where any chemist has found raffinose in cane sugar. That is the only reason that I have for thinking that probably in this case raffinose was not present. Of my own knowledge I must say I do not know. I did not test it for raffinore. I do not know of any way in which raffinose could be found in a hard refined sugar showing a polarization of somewheres in the neighborhood of 99.9.

Q. If that is the polarization, 99.9?

A. I do not say that was the exact polarization; I say sugar polarizing in that neighborhood.

Q. 99.84 is one of your polarizations?

A. That is one of the solutions.

Q. You found 99.84 to be the test of this sugar?

A. No, sir, that was a particular solution.

Q. I mean of that particular solution, No. 1 C, 99.84: if that solution did contain raffinose and did contain invert sugar what assurance have you then that 99.84 was a proper test, was the proper sugar content of the solution?

A. I cannot answer specifically to hypothetical questions of that sort.

Q. That is a proper question.

Mr. PLATT: I object to the question, there being no evidence that the sugar contained any raffinose.

Mr. TINGLE: I am asking this question of the Doctor as an expert.

Objection overruled. Exception.

Q. As preliminary to that I will ask you if it is not possible that this sample of sugar which you polarized might contain invert sugar and raffinose?

A. As my opinion?

Q. I don't want your opinion; I want to know if it is
418 possible?

A. My opinion if it is possible?

Q. Yes.

A. I think it is impossible that it contained any appreciable quantity of invert sugar and highly improbable that it contained any raffinose.

Q. Upon what do you base that statement?

A. I base the statement as to the invert sugar upon the appearance of the sugar and its general form and the facts that have been ascertained in chemistry as to sugar of that grade and class, hard refined sugar. My opinion as to raffinose is based upon the fact which I presume to be a fact, I do not know of it of my own knowledge, that it is a cane sugar, derived from cane, and no raffinose has been found in cane products so far as I know.

Q. Then you base your opinion upon facts outside of your own observation?

A. Outside of my observation in this case, yes, sir. I said before in my testimony that I made no examination of this sugar in reference to its constitution, except such as are indicated by the careful polarization to which it was subjected.

Q. (Question on p. 88 repeated and read.) I mean of that particular solution, No. 1 C, 99.84: if that solution did contain raffinose and did contain invert sugar what assurance have you then that 99.84 was a proper test, was the proper sugar content of the solution?

A. If it did contain raffinose and did contain invert sugar, sup-

posing that it did, what assurance have I that this represents its true polarization? There would be no assurance at all.

Q. What is the difference, Doctor, between testing a raw sugar for the purpose of ascertaining the true sucrose content and polarizing the same raw sugar for commercial purposes?

Mr. PLATT: I object to the question; it does not appear that this gentleman is a commercial expert; he is a scientific expert.

Mr. TINGLE: It appears from his testimony that he gave upon the original investigation that he was familiar with the commercial methods of testing sugar.

By Mr. PLATT:

Q. Did you testify to that?

A. I must say I have not a very clear recollection of the testimony that I gave; there is a great deal of it.

By Mr. TINGLE:

Q. You are familiar with the commercial method of testing sugar, are you not?

A. I am familiar with the commercial method of testing of course from hearsay; I don't test sugars commercially, that is, as
419 gentlemen do who make that their business. I am familiar with methods used in testing sugars commercially from hearsay from my conversation with others, and I have seen it done.

Q. That isn't hearsay, is it?

A. I presume to that extent I am familiar with it.

Q. Now, please answer that question? (Referring to question at bottom of p. 89.)

Mr. PLATT: I object, first, that the witness is not a commercial expert; secondly, it doesn't appear that there is any difference; thirdly, it doesn't appear that there is any particular commercial method for testing sugars; and fourthly, that the act in question does not provide for any commercial method, and therefore it is irrelevant. And in the next place it is indefinite: for what commercial purposes? It doesn't state even for what commercial purposes.

Mr. TINGLE: For the purpose of barter and sale.

Objection overruled. Mr. Platt excepts.

Q. Will you please state what is the difference between those two methods (namely, between testing a raw sugar for the purpose of ascertaining the true sucrose content and polarizing the same raw sugar for commercial purposes)?

A. I can't be categorical about this, because there are so many details, and you can't answer a general question in that way categorically; and it is my opinion if I should answer it in a general way, it would simply be a lecture upon methods and variations in proving different tests.

Q. You can't answer the question, then?

A. I can't answer the question categorically.

Q. Can't you state the method of testing sugars for the purpose of ascertaining the true sucrose content? You know what that is. And can you state whether that differs from the method used in the polarizing of sugar for commercial purposes for barter and sale?

A. I would say in general that the commercial method was the same as the accurate method, that is, the scientific method, in so far as it is possible to apply it; that when you test sugar very accurately, with all the refinements, it is a more lengthy process, more difficult, requires various things that could not be done in a commercial test.

Q. What kind of a test did you use in reaching these results named in this table? Was that a commercial test or was it a scientific test?

A. Speaking now of one particular result?

Q. I am speaking about all those results?

A. Speaking about the general result?

Q. I am speaking of the results that are recorded on this paper (Exhibit G)?

A. As a whole, in general?

Q. Yes, I am talking now about the individual work that you did in that respect?

420 A. Upon that sugar in that series of investigations?

Q. Yes?

A. That was done with all the refinements that are possible to bring to bear upon the problem at issue, which was to ascertain the effect of temperature upon the polarization of sugar.

Q. How does the method that you used in that case differ from the ordinary commercial method of testing sugar for barter and sale?

A. It differs in a great many different ways. In the first place this sugar was polarized hundreds of times, this was only one sugar polarized hundreds of times. That would differ from a commercial valuation, because there would be only one reading, perhaps once or twice or a few times. And also differed perhaps in respect to the instruments used, although I would have to qualify that; I believe some instruments are used in trade which are fully as accurate and possessed of as many refinements as the instrument that was used in this case. And the refinements in regard to the maintenance of a uniform temperature and polarization of a sugar, making up the flask, and recording the temperatures, all are refinements which would not obtain in a commercial valuation of the sugar.

Q. In how far would these refinements you speak of, which were used by you and your co-observers, cause a difference between the results of a commercial test and your results?

A. It would cause a difference in the direction of greater accuracy in the test which we performed. As referring to the content of the sugar, we were not testing the sugar to ascertain its sucrose content; we were making the experiments in the direction of determining the effect of the temperature.

Q. What would be the result, the differing result?

A. The difference would depend upon the accuracy with which the commercial test——

Q. I am talking about your experiments and assuming that they are actually accurate all the way through?

A. Yes, I assume the same.

Q. Would the results be higher or lower?

A. As to the difference in the actual result?

Q. Yes.

A. Would the results be higher or lower as regards the absolute polarization of the sugar?

Q. As regards the polarization of the sugar as compared with the commercial test?

A. This is presuming that our results are calculated——

Q. I am speaking now of the actual work you did. How would the results in the actual work that you performed differ from the results of a test by the commercial method? Would those results be higher or would they be lower?

A. As regards the actual polarization of the sugar?

Q. Yes.

421 A. It would be impossible for me to say unless you also assume a basis as regards the commercial test.

Q. Assuming of course that the commercial test would be conducted in accordance with the methods used in commerce?

A. If the commercial test were made with accuracy it might vary one way or the other, either higher or lower, from our result.

Q. Under what circumstances would it be higher and under what circumstances would it be lower?

A. A great many details would enter into that; it might be lower on some accounts and higher on other accounts.

Q. State what those circumstances might be?

A. Well, the polarization of the sugar commercially to ascertain its sugar content, might be made at a higher temperature or at a lower temperature than the standard prescribed by the instrument, assuming that the results obtained in this course of examination were calculated to the standard of the instrument, and the commercial examinations were not conducted with that direction, the result would vary above or below in proportion as the temperature varied from the standard temperature of the instrument.

Q. As a matter of fact and a matter of practice is the temperature ever lower than 17.5 in the laboratories of the various appraisers' offices in the country?

A. Speaking now about appraisers' offices?

Q. Yes.

A. No, I have never seen appraisers' laboratories lower than 17.5.

Q. They are always higher, aren't they?

A. I think they are.

Q. Then the result would be a higher result than the commercial methods would show?

A. The results obtained by careful polarization and calculated to the temperature of the instrument would be higher—would be lower—to, the polarization of the sugar by a commercial chemist in a room which was above the temperature prescribed for the instrument, that polarization would be lower than the test made in an

accurate way and corrected to the temperature at which the instrument is standardized.

Q. Why would it be lower?

A. That would require another lecture on the subject.

Q. I would like to have you state it in as few words as you can?

A. The influence of temperature upon the rotation of sugar is due to a number of different causes, acting in different ways. It is due in the first place to the fact that instruments which have quartz plates in their constitution are affected by temperature, as the quartz plates are expanded by means of temperature, bringing about a change in their rotary power. It is also affected by increasing or diminishing the content of the water in the flask as compared with the content of the sugar; also influenced by the length of tube in which the observation is made, consequently of diminishing the sugar solution through which the polarized ray passes, and
422 in various other ways, some of which are understood and some of which are probably not very well understood.

Q. I don't hear from you any statement in regard to the influence of the temperature upon the rotatory power of the sugar solution?

A. Part of this effect which is produced by temperature is due to the influence of the temperature on the specific rotatory power of the sugar.

Q. What proof have you of that?

A. Well, the proof lies probably in the fact that, calculating out all the influences that can be ascribed to quartz plate, to the length of the tube, to the influence of the volume of the sugar solution, there still remains a certain amount of influence which can only be accounted for by ascribing it as a factor in the specific rotation of the sugar.

Q. Are we to understand that in making those experiments, of which this paper (Exhibit G) is a record, that you took all those considerations into account?

A. No, sir.

Q. What did you take into account?

A. We took into account merely the total effect of temperature upon the polarization of sugar conducted in the ordinary way, that is conducted in the ordinary way, with such refinement as could be applied without making it an extraordinary way, such refinements as could be applied to the process of polarization.

Q. What refinements?

A. The multiplication of observations, and the incidents of constant temperature, of polarization, the setting of the instrument, with quartz plates, the observation by different observers, and the calculating of the mean of a great many results, and so on.

Q. Are not those precautions taken by all competent polarizers in that business?

A. I don't know enough about other polarizers to make that kind of statement.

Q. Then these differences between the commercial methods and the method which you used in making these experiments is ascribed by you to the difference in temperature between the temperature at

which the instrument is graduated and the actual temperature at the time—that is what I understand you to say?

A. The commercial observations are usually conducted in this country.

Q. Excuse me. What I want to know is whether or not the difference which you say will exist between this method of testing sugar or arriving at the contents of the sugar as compared with the commercial method is due simply to the difference in temperature?

A. I must qualify my answer by saying that these experiments were not directed toward ascertaining with the greatest accuracy the true sugar content of the sugar; they were directed and the
423 refinements were taken to ascertain the effect of temperature upon the polarization of sugar.

Q. But as an incident to that you ascertained the polarization of the sugar?

A. Yes.

Q. There is a difference between that polarization and the polarization by the commercial method, where the temperature is higher than 17.5?

A. Assuming that the commercial method is conducted at a temperature varying from the graduation of the instrument, without correction for that change. I don't want to be put on record as assuming that all commercial polarizations are conducted without reference to the influence that the temperature has, because I have in my own experience found some commercial chemists who do make the allowance of temperature and notably in one case which I would be glad to testify to.

Q. When you made these observations and read your scale you found the reading to be say 99.84; assume that you found it to be 99.84, please state what you did to find it in that case?

A. 99.84 in this first solution that you are speaking of?

Q. What did you find the reading to be?

A. 99.85 in the first, 99.80, 99.85, 99.80, 99.90.

Q. Are those the readings of the scales as you found them?

A. The separate readings of the scale.

Q. What I want to get at is what you found to be the readings of the scale without any so-called correction for temperature?

A. There is no correction for temperature applied to these; that correction is applied later. The temperature is taken in each case, the temperature at which the solution is made up; that is on record there.

Q. (Referring to Exhibit G.) In one case plate reads 100.455, then you say the plate value is 100.36; the instrument too high by .095; sugar reads 99.916; corrected reading you say is 99.821. In that case wasn't there allowance made for temperature?

A. You are reading the average of all the readings, and the average of the plate readings and the correction as applied.

Q. You made the correction as an average, did you?

A. Yes, I made the correction of the polarization by means of the reading of the quartz plate; these corrections were made on the

average of the readings, the average of the averages. That correction was not always entirely due to temperature.

Q. What was it due to?

A. Due partially to the setting of the instrument, that is, a variation from the zero point.

Q. What part of the correction is due to the temperature?

A. I am unable to say?

Q. You are unable to say?

A. Yes. The corrections of these readings, of these solu-
424 tions, by means of the quartz plate was directed towards the establishment of a zero point of the instrument. These quartz plates were not used—they were not used as they are in the regulations.

Q. Am I to understand you that these differences that you speak of here between the commercial method and your method are due to something else besides the difference in temperature?

A. When you speak of the differences between these results and the results obtained by commercial chemists it is absolutely inexact, because those were not tested for comparison with commercial methods.

Q. The difference which the instrument shows, the reading of the scale, and the return, so to speak, of the test as you made it here, to what is that to be attributed?

A. Those are the terms that are used in commercial valuations, and I couldn't apply them to this work; there is no test returned.

Q. You don't make a return of it, but you make a statement of what that test is; you say that the test shows 99.84. Was that the actual reading?

A. That is an average of five readings.

Q. Of the actual readings?

A. Yes.

Q. That isn't the test which you claim to be the true test of the sugar?

A. No, indeed.

Q. You make a correction of that?

A. That is not made to be the true test of the sugar.

Q. What is the difference between the true test of that sugar and the reading?

A. I am afraid I don't understand the question.

Q. 99.84, that first item there——

A. This is one solution that read at 99.84 upon this date; that is the average of five readings.

Q. What was the test of that sugar, the actual test?

A. I don't know; I can't give the absolute test which you want from a single polarization of a single solution.

Q. Then how would you make the absolute test?

A. If I were ascertaining the sucrose content of a sample of sugar, to determine as accurately as possible how much sucrose it contained, I would proceed in somewhat the same way that this series of experiments has been undertaken, but in a different direction. This

series of experiments was directed towards ascertaining the effect of temperature upon the polarization of sugar.

Q. I don't care for what purpose you made those experiments, whether it was to ascertain the effect of temperature or what not; what I want to know is what is the actual test of that sugar by the methods that you adopted? You have given me the readings, but you have not got the test here.

A. I have not got the test of the sugar here. These results
425 would have to be corrected to a certain temperature. These experiments have nothing to do with the temperature at which the instrument is standardized. The instrument is standardized presumably at the temperature of 17.5.

Q. That temperature there or that test as given there (referring to Exhibit G), which shows the reading of the scale, the average reading—that is the reading of the scale, is it not?

A. That is the average of five readings of the scale, not five solutions of sugar.

Q. Does that represent the test of the sugar?

A. It does not represent the absolute polarization or sucrose content of the sugar determined with the greatest accuracy.

Q. It does show, however, what the polariscope shows to be the reading?

A. At that temperature, on one solution made up in this way.

Q. It shows by the polariscope what you have stated?

A. You would have to calculate out of all those details, because they are all important. It doesn't show what the polariscope would give as the test of that sugar; it shows what the polariscope gives at one particular temperature and under the conditions that prevailed at that time.

Q. It shows the reading of the polariscope?

A. It shows the mean of five readings of the polariscope.

Q. But as I understand you, that isn't according to your theory, the actual test of the sugar?

A. No, not the true test of the sugar.

Q. And you cannot tell me now what the true test of that sugar is?

A. I can very easily figure it for you what would be regarded from these results as the true test of the sugar.

Q. Figure it out and tell what it is?

A. Take this average of results at these low temperatures, for instance——

Q. Take that particular item that I spoke of.

A. That wouldn't give it with the greatest accuracy because that is only one.

Q. I want to know about that one.

A. That one, the correction would have to be applied to that 99.84, polarized at a temperature of 20°. The instrument is standardized at a temperature of 17.5 presumably. Some of the instruments, I understand, are standardized at 20. Presuming that this instrument is standardized at 17.5, the correction would have to be made for two and one-half degrees of temperature above the stand-

ard; and the factor having been ascertained, as we have it here, .03 for each degree, the correction to be applied would be .03 times 2½, the number of degrees, .03, the change brought about by one degree in temperature, which would be .075; and as the temperature of polarization is above, that would have to be added to the
426 polarization obtained at the temperature of 20; consequently making this polarize 99.915.

Q. And the original is how much, the reading of the scale?

A. The average of the settings was 99.84.

Q. And you make it how much?

A. Corrected for temperature, with this correction for temperature, 99.915. I can't say as to the accuracy of that calculation; it is made off-hand.

Q. It is made upon the arbitrary assumption of .03 for each degree?

A. That factor is taken.

Q. Then, if I understand you, it isn't the test shown by the reading of the scale that gives you the test of the sugar, but that test plus this addition that you have given us?

A. Speaking about either cases here?

Q. Yes.

A. This reading as given for this first solution and this figure that has been taken in the results would have to be corrected not only for temperature, but also for the variation of the zero point of the instrument, for the lamp and light and at the time in which the observation was made; also for the flask, if it varied from the true standard, with various other minor corrections.

(Recess taken at 1.50 until 2.20 p. m.)

Cross-examination by Mr. TINGLE:

Q. You are familiar with the regulations of 1897, prescribing the method of testing sugar?

A. I am fairly familiar with them; I have not examined them of late.

Q. You are a member of the committee that made those regulations?

A. Yes, sir.

Q. You know what they contain?

A. Yes, in general.

Q. Now, if a sample of sugar is tested by those regulations and found to read on the scale 95, and the temperature of the room is 27.5, what would be the test reported under those regulations?

A. The test reported, in the first place an average of different readings; that is to say, different readings would be taken on the same solution.

Q. I said it read 95.

A. As a mean of those readings. Then the quartz control plate is used in the place of the sugar sulution and its variation from the scale value at that temperature is applied to the reading obtained; in that way the reading to be reported is to be obtained.

Q. What would be the reading reported, when you have given the reading 95 as shown by the scale and I have given you
427 the temperature as ten degrees higher than the normal temperature of the instrument?

A. The readings by these regulations are corrected by quartz control plates.

Q. Tell me what would be the return made in that case?

A. You mean to figure this out for the difference in temperature?

Q. Yes.

A. This sugar reads 95 and the temperature of the room is at 27.5, ten degrees above the normal temperature; then that would be subject to a correction of .3 for the temperature and this sugar would read .3 too low; therefore the corrected reading for the temperature would be 95.3. That is in general, of course.

Q. Then that difference of .3 is to be ascribed solely to the difference of temperature, is it?

A. I have corrected it for you for the temperature as you told me.

Q. I am talking about the regulations.

A. The regulations prescribe the use of a quartz control plate, which corrects not only for temperature, but also for any variation from the zero point and also for the content of the flask used.

Q. Is the .3 included in that?

A. Yes, sir.

Q. What I mean to say, are the corrections by the control plate and the difference in the flask used included in that .3.

A. Yes, sir. This .3 is included in the corrections brought about by the use of the quartz control plate.

Q. Don't you understand that the .3 correction, as you call it, is necessary simply on account of the temperature?

A. Well, I figured that out here for the temperature, supposing that you meant merely to have me state what the variation was due to in regard to the temperature. Now, when you are speaking of the regulations, of the method of testing sugar by the regulations, I say that that is brought about by the use of the quartz control plate, with a certain assigned value. The assigned value of this quartz plate corrects not only the variation due to temperature, but at the same time variation of the setting of the zero of the instrument, the variation of the zero of the instrument from a true setting, and also the size of the flask.

Q. I understand all that; that is a part of the machinery; but the correction for temperature in this case would be .3, would it not, under the regulations?

A. Not under the regulations; no, sir. That is the amount of correction for temperature, which enters into the regulations; that is the figure upon which the regulations are based for correction of temperature.

Q. Yes, .3.

A. Yes.

Q. For each ten degrees?

A. Yes, sir.

Q. Then, this correction then is due to the temperature, isn't it?

428 A. And other things, speaking of the regulations.

Q. I beg your pardon, the regulations require a correction of .3 for each ten degrees, or .03 for each degree, for the temperature?

A. That much for the temperature and also that value includes other corrections for other variations.

Q. This .3?

A. And the variations of the instrument from the zero point, and also the size of the flask.

Q. That has to do with the corrections of the instrument, the corrections of the work, but I am talking now about the correction for the temperature; that .3 is a correction for temperature, isn't it?

A. Yes, sir.

Q. Then you add .3 of a degree to the 95°, as shown by the scale of the polariscope, for a correction of temperature?

A. Yes.

Redirect-examination by Mr. PLATT:

Q. This statement that is in evidence, Exhibit G, what was that made to show?

A. It shows the influence of temperature upon the polarization of sugar.

Q. And made up for that purpose chiefly and only?

A. Chiefly and only to show the variation due to temperature; to enable us to testify understandingly as to that influence and to the amount.

Q. Amount of that influence?

A. Yes.

Q. Now, something has been said here about a commercial test; what do you mean by a commercial test? Is there any such thing as a commercial test?

A. There is no such thing that can be strictly defined, to be generally defined, I suppose, as the customary usage amongst people who test sugars as a matter of trade.

Q. Do they vary in their results?

A. They do, yes.

Q. And in the accuracy of their instruments?

A. Certainly.

Q. And is there anything so far as you know as a uniform commercial test?

A. No, sir.

Q. Have you ever been a commercial chemist?

A. No, sir.

Q. Had no experience in that?

A. No, sir.

Q. In your opinion as an expert, could any correct polariscopic test be made of sugar without any allowance being made for temperature?

429 A. Unless only in one case, the case that the temperature is that at which the instrument was standardized.

Q. If the temperature is the same as that at which the instrument is standardized, why then there is no allowance?

A. No correction for temperature is required.

Q. And the result of all the experiments that you have made and taken part in leads you to the conclusion that .03 for every degree of centigrade is the proper allowance for temperature; have those experiments gone far enough in your opinion to make that substantially uniform?

A. Yes, sir.

Recross-examination by Mr. TINGLE:

Q. You say there is no such thing as a commercial test?

A. There are commercial tests, yes.

Q. You said awhile ago that you didn't know anything about a commercial test, that you didn't know of any such test?

A. I don't know of any peculiar system of testing sugars which is commonly known as commercial testing.

Q. Don't you know that there is a method of testing sugar used by trade chemists?

A. Trade chemists use methods for testing sugar.

Q. Do you know what that method is?

A. I know there are methods of testing used by commercial chemists. Just what particular prescribed method is used I couldn't say.

Q. Don't you know that there is a particular prescribed method of testing sugar that is used by commercial chemists and which was used by the Treasury Department up to the date when these regulations of 1897 went into effect?

A. No; I simply know that this allowance for temperature was not made by commercial chemists as a general thing to the best of my knowledge prior to the promulgation of the regluations of the internal revenue office, if that is what you want.

Q. Do you know whether or not this method of correcting for temperature in accordance with the rules prescribed by the Treasury Department in 1897 has been adopted generally throughout the trade for testing sugar?

Mr. PLATT: I object to that as irrelevant.

Q. I ask you whether that method of testing sugar has been adopted by the commercial world?

Mr. PLATT: Objected to as immaterial and irrelevant.

Objection sustained; exception.

Answer insisted upon and admitted under rule XI.

Mr. TINGLE: I mean the method of testing sugar by correction for temperature.

430 The WITNESS: It has been adopted by the chemical profession, as shown by the publication of these methods in chemical journals, and as indicated by the fact that no objection has been raised to these methods as published; and it has also been adopted by the association of official agricultural chemists and has

been in use by that body for a great many years, all subsequent to the publication of the methods which were prescribed in connection with the bounty on sugar by the internal revenue office.

Q. Name the leading chemists of the world who have given their assent to it.

A. The formal adoption of this method of testing, of this allowance, by this association that I speak of is the only instance where I can say it has been formally adopted.

Q. What is the association that you speak of?

A. The Association of Official Agricultural Chemists.

Q. Who are they?

A. They are composed—the body is constituted of chemists in connection with the agricultural experiment stations in different parts of the country.

Q. All under the direction of Dr. Wiley?

A. No, not under the direction of Dr. Wiley so far as I know; no doubt in conformity with Dr. Wiley's methods, because he is the chemist of the Agricultural Department, and these gentlemen are connected with State stations.

Q. They report to him, don't they?

A. I don't understand it so. I am not in the Agricultural Department.

Q. To whom do they report?

A. They report to the directors of their stations, State stations.

Q. Then, is this confined, this method confined to this country, as far as your knowledge goes?

A. As far as my knowledge goes. I know only of the publication of these methods in the European journals and also of the fact that no criticism has been made of that feature.

Q. Do you know as a fact that no criticism has been made?

A. I have not seen such criticism. I don't cover the entire range of chemical literature, but my knowledge of it is somewhat extensive and I have to examine a considerable number of journals in connection with my work. I have seen no published criticism of that method since its publication.

Q. Do you know anything as to whether this method of testing has been adopted in the buying and selling of sugar in Europe?

A. No, I can't say as to that.

Q. Do you know what foreign chemical societies have adopted the same views?

A. I am somewhat familiar with the prescribed methods——

Q. Answer the question.

Objected to as irrelevant.

431 Objection sustained.

Answer insisted on and admitted under rule XI.

A. No, I don't know as to that.

ANDREW BRAID, called as a witness on behalf of the United States, being duly sworn, testified as follows:

By Mr. PLATT:

Q. Mr. Braid, what is your profession?

A. I am an assistant of the United States Coast and Geodetic Survey.

Q. You have been a witness before in this case?

A. Yes.

Q. Have you recently made any experiments in regard to the influence of temperature upon the polarization of sugar?

A. I have.

Q. How recently?

A. Last November.

Q. Will you give us the results of those investigations and experiments?

A. The result of the observations, made in conjunction with the two gentlemen who have already testified this morning, Messrs. Tittmann and Crampton, confirmed what we had previously adopted, namely, .03 of one degree Ventzke as the correction to be applied for one degree of temperature centigrade.

Q. How many experiments have you made recently in order to establish that proposition?

A. These experiments extended over a period from November 8 to November 16th, 1899. Shall I go ahead and describe what we did?

Q. Yes, in a general way.

A. In the first place the room was assigned, which was a room most suitable for the purpose; it is a room in the Coast Survey office, a room belonging to the weights and measures office. We took great care to provide as far as possible for a maintenance of a uniform temperature during any single day of the observations, and we took pains to have the instruments, the quartz plates, and the water from which the solutions were made and the sugar itself all sufficiently long in the room, so as to be sure that they all had the same temperature. The first temperature that we observed was about 20° C. The sugar was carefully weighed out, dissolved in water in the Mohr flask, and used for observation in a tube of the usual length, 200 millimetres. When the solution was ready for observation it was placed in the polariscope and never less than five consecutive readings were made. For instance, we would manipulate the quartz wedge until the field was uniform, then take the reading from the scale of the instrument, then instantly throw it off again, re-
432 point, and so on five times in succession. The reason of that is that no instrument is absolutely accurate, neither is any observer absolutely accurate; and a greater degree of accuracy can be obtained by taking the mean of a number of consecutive readings than by taking a single reading. This tabulation of the results (showing a paper), which is the same as has already been submitted, simply gives the means of those five readings in each case, for each solution. Now, the temperature of the water was observed

before we made up the solution; the temperature of the solution was observed before polarizing, so that our record would show as nearly as we could read it the actual temperatures. Now, we pursued that same system with various solutions one after the other. We first observed during two days at low temperatures as low as we could get without adopting artificial means. Then we had the room prepared for high temperatures, and we didn't begin to observe at the high temperatures until that room had been heated at least 48 hours, with the instruments and the apparatus there, to be sure they had all partaken of this change of temperature. Then we began the observations at high temperatures, during which time fifteen separate solutions were independently made and read in the manner indicated by all three of the observers. Then we prepared the room again for returning to the low temperatures; and then repeated the same process as before. Now the mean result of all the low temperatures, the average of which was about 17.8° C., and the mean of all the observations taken at the high temperatures, which was about 28°,—I am just stating this approximately, I am not giving you the precise figures—then the difference between these two rates, all the observations having been conducted in the same manner, the difference between the results obtained at the low temperature and those obtained at the high temperature gives the effect of temperature upon the whole process of polarization. Now, it is immaterial how much of that is due to the change in the rotatory power of the quartz plate, how much is due to the change in the rotatory power of the sugar, how much is due to the expansion of the scale of the instrument, and these other minute differences which temperature effects; what we are after is the total effect on the polarization of the sugar; and that we obtained by dividing that difference by the number of degrees between the average of the low temperatures and the average of the high temperatures. Dividing that difference by that temperature difference we get the effect of temperature for one degree, dividing by the number of degrees of course gives the effect for one degree of temperature. That we find to be .030, the mean of the three observers. I have also computed the three observers' results independently.

Q. They are all practically identical, are they?

A. Mr. Tittmann's result was .029; mine was .031; Dr. Crampton's .030; the mean of the three is .030. That is practically identical also with the result obtained by other observers, Dr.
433 Wiley and others. Now, I omitted to state that in reading these solutions we always used the quartz plate, because if the zero point of the instrument is misplaced any error due to that would be reproduced in every reading of a sugar solution; if the zero point was out of position, say .5 of a degree, every polarization made on that instrument would be out correspondingly .5 of a degree. And the quartz plate controls that, because we know the actual value of that quartz plate and its actual reading in the instrument; if it doesn't coincide with its known value we know there is an error in the adjustment of the instrument. And the purpose of these observations, as I have said, was to get at this effect of temperature only.

We were not seeking to determine the absolute sugar content of the solution, although we can easily deduce it from these observations, but the experiments at the high temperature and those at the low being conducted in precisely the same manner, the difference between them, whatever it is, is certainly the effect of temperature only.

Cross-examination by Mr. TINGLE:

Q. Professor, can you tell us what is the exact effect upon the rotatory power of sucrose?

A. I have never personally determined that; I know what the accepted value is among chemists; they don't agree precisely in the amount, but approximately they are the same. It is about, if I remember correctly, .17 of a degree Ventzke for ten degrees of temperature; that would be .017 for one degree.

Q. Is that admitted by chemists generally?

A. I think it is by those who have paid special attention to that subject; it is very possible that it is not known to all chemists, to those who have not had occasion to use it in this particular connection.

Q. Do you not know that many eminent chemists have denied that proposition?

A. Yes, I know that in the old literature on the subject it is generally denied, perhaps not universally, but generally; but some of these same authors in their more recent works have admitted it. Take Landolt, for example; I forget the date of the edition of his book; he said in that that the effect of temperature was small and might be neglected, but in his later edition he gives a value for it which is slightly larger than we have claimed.

Q. What other chemists?

A. I cannot recall them all just now. Some trade chemists have been aware of it for a long time and have used it.

Q. Who, for instance?

A. You have had witnesses here already; there is Prof. Harrison, for example, from British Guiana.

Q. I am speaking of chemists in this country?

A. There is one of the trade chemists of Boston; I don't
434 remember his name; when he was spoken to about it, when we were at Boston on our trip of inspection of the custom house laboratories, he stated distinctly that he had always used it, and he was sorry for his brother chemists that had failed to use it and were not aware of it.

Q. Can you give us his name?

A. I couldn't give you his name just now; I could ascertain it for you.

Q. Do you know whether Landolt's last conclusion was due to his own experiments, or whether he quoted somebody else?

A. That I am not sure about.

Q. Don't you know that he quoted Schonrock in that connection and that what he said was simply a quotation from the Ztschr. fur Instrumentenkunde?

A. That may be, but he evidently adopted it when he put it in his own work.

Q. Wasn't that written by Schonrock and published over his own signature?

A. That I don't know. This particular article in Landolt was not; this occurs right in the text of Landolt's own work, and the reference to any one else is simply in the foot note; the reference to Schonrock is simply in the foot note.

Q. If I understand you then the amount of the difference due to temperature is .017 for each degree of centigrade?

A. About that.

Q. Then there would be .013 in this .03 to be accounted for?

A. Yes, part of that is due to a change in the specific rotatory power of the quartz.

Q. How much of it?

A. That is usually given at about .15, just a little smaller than the effect on the sucrose, and they are in opposite directions; the specific rotatory power of quartz is increased by increase of temperature, while the rotatory power of sucrose is diminished by increase of temperature, hence when you come to apply the corrections these two quantities are additive.

Q. I will ask the same question that I asked Dr. Crampton; you test a sample of sugar and find it to be 95 on the scale, and the difference in temperature we will say is 10°; what do you report to be the test of the sugar?

A. It would depend in the first place upon whether your instrument was in proper adjustment.

Q. Assume everything is correct?

A. Then it isn't always correct to assume that.

Q. I will assume that for the purpose of this question?

A. I will have to make two answers to that question. I would have to tell you how we used it in this particular instance; I would have to tell you how we use it in the custom house by following the regulations.

435 Q. I want to know how they do it in the custom house by following the regulations?

A. The way they do it in the custom house by following the regulations is, 95 is the reading taken on the instrument; then all these corrections for temperature and flask, etc., are made in the value of the quartz plate, so as to save the observers going to the trouble of making calculations, and hence it is a little advantage over the way we did here in these solutions. If the reading of the sugar is 95, and we read also that quartz plate; now let us suppose that the quartz plate value at 17.5° is also 95, but this observation, this polarization, having been made at a different temperature from 17.5, a table which is furnished of sugar values of the quartz plate at different temperatures must be referred to to find the temperature used, and take out the value from that table; that value will differ from the reading which they obtain on the instrument; the difference between those two readings is taken; for example, if the reading value of the quartz plate is 95 and its tabular value at the tempera-

ture used is 95.6, then you say that the instrument reads too low; it only read 95, whereas the value of the plate for that temperature is 95.6; hence if the instrument is reading too low, the amount of that mis-reading must be applied to the polarization of the sugar to get its true polarization.

Q. That would give you a polarization of how much?

A. In that case it would be 95.6. But that correction understand, as they apply it, includes not only the temperature correction but also the error in the zero point of the instrument; that is all taken together in the reading of the quartz plate and the instrument.

Q. If there is an error?

A. If there is an error.

Q. Then you find the test is shown by the polariscope to be 95 and you add .6?

A. In that particular case.

Q. To make what you call the corrected test?

A. Yes. That is rather a large quantity; ordinarily it doesn't come to anything like that amount. Simply an illustration.

Q. On the return made by the operator then is that the test, 95.6?

A. In that case; yes, sir.

Q. But the polariscope shows 95?

A. Well, the reading of the polariscope in any case unless all the conditions are standard; that is, the sugar made up and polarized at the temperature which the instrument is standardized; that is, 17.5, and no error made in weighing out the sugar or making up the flasks, if all the conditions are standard, then the direct reading of the instrument would be the true polarization without any corrections.

Q. I am not talking about that; I am talking about this particular instance?

436 A. In this particular instance we have assumed that the sugar was polarized at a temperature considerably away from 17.5 and hence the reading on the instrument was wrong.

Q. The reading on the instrument is assumed to be wrong?

A. It is not assumed to be wrong; it is known to be wrong. It is often customary in custom houses and in the trade also to use a tube of half length in polarizing sugar; now, a solution of pure sugar polarized under such circumstances will read 50 on the instrument; would you claim that 50 was the true polarization of that sugar?

Q. What authority have you for the claim that the temperature influences the specific rotatory power of sucrose by 0.017 Ventzke for each degree of Centigrade?

A. As I stated, I got that from my reading on the subject; I have never determined that quantity myself; but it is immaterial, for what we are after here is the total effect of temperature on the polarization; it doesn't matter how much of it is due to the quartz and how much of it is due to the sugar; that (pointing to paper witness holds) that is the total effect and that is what we have to use.

HARVEY W. WILEY, called as a witness on behalf of the United States, being duly sworn, testified as follows:

By Mr. PLATT:

Q. Doctor, have you made any recent experiments in regard to the influence of temperature on the polarization of sugar?

A. Yes, sir; I have made quite a number since my last testimony was given here.

Q. Will you state what the results of those experiments were and where they were made, and what sugar you used and where did you get it?

A. The sugar I used is part of a lot I got some three or four years ago from the American Sugar Refining Company on special specifications. When beet sugar commenced to come into this country in large quantities I thought it would be well to have in stock for scientific uses sugar which was known to be purely of cane origin. I, therefore, placed an order with the American Sugar Refining Company for a barrel of pure cane sugar, which they would certify was made solely of the sugar cane; in response to that request I received a barrel of sugar, with a statement from Mr. Searles, who was the treasurer of that company, stating that it was made of nothing but cane sugar. This sugar, I still have a large quantity of it and use it constantly for scientific purposes. This is the sugar which I used in the late experiments of which I have spoken, as well as in the earlier ones, the same sugar which I used which has been already offered in evidence. The results of my recent investigations, which were made in the laboratory of the ap-
437 praiser in this city, with different instruments from those I used before, different tubes, different flasks and different balances, all different except the sugar itself, gave almost the identical results which were first referred to in my original evidence, showing the total effect of temperature on polarization—I can't quote the exact decimals—to a thousandth here, but to the second place of decimals—I think it was .031, or in round numbers .03 for each degree C., confirming the original results.

Q. About how many of these experiments did you make?

A. In this last series?

Q. Yes.

A. I should say I made about a hundred readings in all on about twenty different samples, five readings on each sample, and at three different temperatures.

Q. And the results substantially uniform?

A. Yes, sir.

Q. Doctor, do you know Mr. Wolfbauer?

A. Yes, sir, I have the pleasure of his acquaintance.

Q. Edwin Wolfbauer. I call your attention to part of his testimony in this case; I read from his testimony, page 7, taken before the referee, in which he states he "has found certain scientific inac-
"curacies: for instance, when the author speaks on page 577 of read-
"ings made of identical sugar solutions, made under identical cir-

"cumstances and made at identical temperatures, he gives readings "which vary in one case eighteen one-hundredths of one degree, "and right on the same computation there is another two readings "which vary sixteen one-hundredths, and the circumstances are "identical, the only difference being the color of the light. It is an "acknowledged and unquestionable fact that the maximum differ- "ence of light would justify perhaps two one-hundredths, though "usually in those scientific investigations in the average of many "readings it don't show any. A difference of eighteen one-hun- "dredths would even be regarded as objectionable in purely com- "mercial and factory work, not to speak of the scientific investiga- "tion."

Have you anything to say in regard to that comment on your paper read before the American Chemical Society?

A. I have not referred to the data in my paper in a couple of years; I don't recall exactly what the differences are. It is well known, however, to users of the polariscope that the character of the light in connection with the personal peculiarities of the observer, that is in his eye, makes considerable difference in the tint of instruments, and therefore it is always desirable to have the light of the same character and of the same intensity in making direct comparisons. In my original work I sought to cover this possible source of error by using three different kinds of light and making parallel determinations throughout with the different kinds, and as far as I could I kept those three different kinds of light at
438 the same degree of intensity throughout. There was one case where I was compelled to depart from this, namely, when I was working in the cold storage room at the temperature of zero; there I did not have the facilities to secure exactly the same kind of light that I had in the other part of my work, and if my memory serves me there were some slight variations due to the character and intensity of the light in these circumstances which could not have been avoided. The fact that an investigator's observations do not always coincide I do not believe is regarded by scientific men as an impugnment of the accuracy of his observations. On the contrary, we are inclined to look with some degree of suspicion upon hundreds of observations which absolutely coincide. If I were criticising another gentleman's work I would say that slight variations from the standard would not be any cause for doubting the value of his work, especially if he makes no attempt to conceal them and brings them all into the paper for the judicial consideration of scientific men.

Q. This witness also says there is a "further inaccuracy on page 594," he says, "It shows in the computation of all the results ob- "tained in the experiments, where he told the averages representing "the influence of temperature and the specific rotatory power. It "shows that the influence of the temperature for the range between "25 and 30 degrees centigrade is almost twice as large as between "20 and 25, and again between 30 and 35, which are the next ad- "joining ranges; between 35 and 40 again the difference chooses to

"be larger yet than between 25 and 30. Those differences are cer-
"tainly against all rules of variations in physical laws. But not to
"speak of that the author simply adds them up and averages all
"those differences. If we take his average and compare it with
"the highest figure and with the lowest figure, we find that it differs
"in value an average 33 per cent. one way and 46 per cent. the
"other way, which means that the work had been executed with the
"factor of inaccuracy of 79 per cent. To explain that statement
"in more popular language, easier to comprehend, we are entitled
"to compare it with an analogous case. Suppose a man was measur-
"ing a piece of cloth and he found it, after making a series of
"measurements, to be a minimum 25 inches long and a maximum
"52 inches, and then he would simply add up all his measures and
"find the average and call it a yard."

What have you to say in regard to that criticism on your statement, Doctor?

A. I must be allowed to say that I hardly think that is a criticism which falls within the limits of ordinary scientific procedure. In regard to the laws of nature, physical laws, which he says are always uniform, I scarcely know one that is; for instance, the rate of expansion of water is very different at different temperatures; from four degrees on the water expands up to the boiling point, but with very different degrees of rapidity, greater than are indicated here for variations in specific rotatory power; and yet I don't think that Dr. Wolfbauer would at this day care to deny the fact that
439 the rate of expansion of water at different temperatures is very different. If you go below four degrees water actually begins to increase in volume, instead of growing smaller as it does in going from a hundred down to four degrees, it begins to expand in bulk very rapidly. The law of nature is that water as you heat it expands in volume, and yet that is only true from four degrees up, and then not at the same rate. After you go below four degrees it begins to increase in volume as you cool it, just contrary to its other condition. So when water becomes ice it is very much lighter than water at four degrees, otherwise ice would always sink to the bottom. I am not here to defend the laws of nature, as I didn't establish them, but they are not uniform as indicated by Dr. Wolfbauer. But his criticism is altogether contrary to the facts of the case, even in so simple a case as water. This criticism is better answered by observing this curve which I have constructed (referring to p. 583 of the Journal of the American Chemical Society), the straight line being the theoretical condition of affairs which I have shown; the straight line shows what would be the theoretical condition if the rate of rotation changed equally at all temperatures; the curved line is what I actually found by my own specific determinations, and you will see that it coincides very closely with the theory, but varies from it slightly at different points, but hardly as great as the difference he refers to, 52 and 36 inches. I do not claim that these are the final determinations—I should be very far from doing that—this was the first series only; if I should go over this work again and find them slightly different I should claim the

right of correcting them. But these determinations as they are indicated by the first series of observations, I carried on with a great degree of care as I testified to before.

Cross-examination by Mr. TINGLE:

Q. I believe you testified in your main examination before the board that you are familiar with the commercial methods of testing sugar?

A. I am familiar by observations with the methods of some commercial chemists. I know of no established method established by law or by common agreement which may be called the commercial method; I have never seen any statement of agreement among commercial chemists.

Q. To what did you allude when you spoke of commercial methods?

A. I mentioned the fact that I was in the laboratory of Mr. Sherer, and I have been in other laboratories, and I have observed the way in which they test sugars; but each one of these gentlemen standardizes his own instrument without reference to what his fellow chemist is doing; and, as I understand, there is no common agreement among them to refer all their polarizations to a common
440 standard. I will be very glad to describe to the court what I have observed in these laboratories if that would be any help.

Q. Now, in your main examination before the board you were asked this question:

"Q. Are you familiar with the methods of polarizing sugars used by commercial houses—please state them?

A. Yes, sir; the method was so well stated by Doctor Weichmann and met my entire approval, I will let his statement stand as mine."

A. His is the only commercial house that I was ever in; the other places I have been have been trade chemists.

(Reading further:) "Q. Will you state in what particular, if any, they differ from the method pursued by the Government at the present time by the present regulations?

A. Both methods of polarizations reach identically the same result when correctly performed. The method of polarization if performed at 17.5 C., at which temperature it was meant, will reach the same result in either case. The Government instruments now employed are standardized for any temperature which may happen to obtain, therefore, they necessarily give correct results, whether it be at 17.5 or 40 degrees C."

The WITNESS: I still maintain that, if the commercial chemist uses instruments graduated at 17.5 and would make all his polarizations at 17.5, he would reach correct results. I have never observed anything else in their methods which is a departure in principle from ours; so far as I have observed these methods, they lead to the same results exactly, temperature excepted.

Q. What would be the difference, then, between the polariscopic test as ascertained by the present Treasury regulations and the

polariscopic test ascertained by the methods used by commercial houses?

A. I will say that if they use the same sample of sugar, there would be no notable difference if both polarizations were made at 17.5; there should be no difference whatever.

Q. Suppose the temperature is 27.5?

A. Then the method used in the commercial houses as I have observed it so far would give a polarization too low.

Q. But how much?

A. Of about .3 of a degree.

Q. That is to say, the polariscopic test as shown by the scale would be .3 of a degree too low?

A. I say that if they should report the reading as they observed it on the instrument it would be .3 of a degree below the truth.

Q. Doctor, in your testimony in regard to the recent experiments made by you, you testified to the conclusions reached. Please give us the details of those experiments and how you reached the conclusions?

A. I used the same sugar, that I have referred to as furnished by the American Sugar Refining Company two or three years
441 ago, and before this question ever came up for discussion. I have no notes with me of the polarizations, but I think I can recall them approximately, because they were made this year, in January, I think it was in January of this year.

Q. Yes.

A. The polarization at 6° was obtained by carrying all the apparatus, sugar, water and everything into the cold storage room at the appraiser's stores, where they were left over night, and the windows opened; it was rather a cold night. They had no artificial refrigeration at the time, although this room is prepared for refrigeration. In the morning at nine o'clock I began the operations there, in connection with other gentlemen; I was making the readings independently, however. We had a delicate thermometer suspended near the instrument, and we adjusted the windows so that the temperature changed very slightly during the whole course of the observations. If I found the temperature rising, which it would naturally do on account of the heat of the body of the observers and of the lamp, we would open the window a little more until the thermometer would stand again about 6°; if it were getting too cold we would close the window; in that way for two or three hours we kept the temperature within about one degree. Meanwhile the solutions were all made up at this temperature and the temperature of the solutions also carefully taken. The readings were made at this temperature, and my readings showed the polarization of about 100.4. Previously we had worked in a room at about 31 degrees, and made the same series of observations at that temperature, and the polarization at that temperature was about 99.65. I must say to the court that I give this last by computation, because I only remember the polarizations. I am working backwards. This showed in round numbers a variation of .03 for each degree. I only want to say it is

a little larger than one of the factors given to-day, the difference being 24° in temperature; that is, in other words, a sugar furnished me by the American Sugar Refining Company, at 6° polarizes 100.40; the same sugar polarized at about 30° polarizes 99.65.

Q. Now, give us the third temperature?

A. The third temperature was the ordinary room temperature, about 23°, and the reading of that was 99.78, I think, or 99.80, may be 99.85; it was somewhere about 99.80; 99.85 I think I got; same sample of sugar.

Q. Were these the tests testified to by Dr. Austin?

A. Yes; we read at the same time, but I didn't get the same readings as he did; there is a little difference in our eyes; I, however, did not communicate my readings to him until he had finished his work. All our readings varied, as ordinary observer's readings do vary, and from each other by quite a little amount, but the maximum variation between his high and low readings was almost exactly the same as between my readings.

Q. Were these exact readings or were they corrected?

442 A. I read each time five times and made a mean of the five readings and with no correction whatever; no corrections were made on these readings. They were simply taken directly from the scale; there were no corrections at all, except we read a quartz plate each time to see that the zero was in adjustment. Instead of making the correction of the reading we moved the instrument to zero, which is very easily done.

Adjourned.

United States Circuit Court, Southern District of New York.

No. 2918.

BARTRAM BROS.
vs.
THE UNITED STATES.

No. 2919.

BENJAMIN H. HOWELL, SON & CO.
vs.
SAME.

No. 2920.

THE AMERICAN SUGAR REFINING CO.
vs.
SAME.

Hearing resumed, January 11, 1901.

Before Hon. William B. Howell, as officer of the court.

Appearances.

For the importers, H. B. Closson and A. K. Tingle.
For the United States, Henry C. Platt, assistant U. S. attorney.

HARWOOD HUNTINGTON, called as a witness on behalf of the United States, being duly sworn testified as follows:

By Mr. PLATT:

Q. Doctor, what is your profession?
A. Consulting chemist.
Q. What experience have you had in that direction?
A. As to qualifications, I would say: I graduated from Trinity college in Hartford with honors in natural philosophy and chemistry, taking the first prize; then I came to the School of Mines, Columbia college, where I subsequently got the degree of doctor of philosophy; I studied abroad for a couple of years and then I came home and was engaged as chemist and afterwards as superintendent, first in the Norwich bleachery and then at Sears Brothers in Providence, Rhode Island, where I stayed for three years; I then had opportunity of teaching at Harvard college and was assistant in
423 the course of descriptive chemistry for two years; then I was elected as fellow in chemistry at Columbia university and came to New York; after that I opened a laboratory for analytical and consulting chemical work and that I opened about 1896; I have often given evidence in the United States courts and before legislative com-

mittees. In my laboratory I had a good deal to do with the testing of sugar; one of my clients in one month sent—I have forgotten just the number, but it was in the hundreds—and in this testing which I had to do I used the polariscope, with which I am thoroughly familiar in the application and use of it as an analytical chemist.

Q. Have you made any experiments in regard to the influence of temperature upon the polarization of sugar?

A. Yes, sir. I made these tests about a year ago. And I first took all my instruments and tested them most carefully and conscientiously.

Q. Where was that?

A. In my laboratory in the Wood exchange here in New York. The polariscope which I tested with the quartz plates from Washington, and my balances I tested, my normal weight I tested with a set of standard weights which had been passed by the German Imperial Government; the balance was tested and found to be right; the 200-millimeter tubes were measured at the Stevens Institute of Technology. Then I made the tests with sugar at different temperatures. The test for 23° C. was made February 7th, 1900; the readings were 99.8 throughout; I took five readings; in making these readings I would adjust the instrument to the zero point, taking care it was in perfect shape, making any correction on the red scale, and then insert the tube and make the reading; I would note the reading then on the black scale, throw the instrument out of adjustment, so that the half shadow would appear unequal, then to bring it again so that the two hemispheres in reading would be quite of the same tone, then making the reading and note that. The readings throughout in this case happen to be 99.8. The correction- for the flask make the readings, subtracting this correction from the average of the readings, 99.72. Another reading which I made at a cold temperature, I made it on January 30, 1900, and the average reading was 100.2, and the correction for the flask being .08 made the corrected reading 100.12. This average difference per degree centigrade is 0.0307. These readings made on January 30 were at the temperature of 10° C. and those on February 7 at 23° C.

Q. Have you now described the manner in which these tests were made? How was the balance tested?

A. The balance was tested allowing it to swing until the pointer comes to the zero point on the scale, after the preliminary cleaning. It was then again tested with a load to see that it swings to the zero point.

Q. In regard to the sugar, was that carefully washed in the flask?

444 A. That is weighed, and I have a nickel dish with a counter weight which just balances on the scales; then the normal weight was put on the one side of the scale and the sugar in the nickel dish. This nickel dish has a mouth, and the sugar can be partially dissolved and washed from thence into the flask; it is then shaken until it is dissolved and then made up to the mark on the flask.

Q. Did you take any care in handling the flask so that no alteration in temperature would take place on account of your hand?

A. By carefully holding the flask by the neck and sometimes wrapping the neck with a piece of paper, so that no temperature could be given to the liquid from the hand.

Q. And after the solution was complete was the flask, what was the mark on the flask?

A. It is filled to the 100 mark.

Q. The millimeter tube, was that rinsed with the sugar solution?

A. That is rinsed twice with the sugar solution.

Q. Then filled?

A. Then filled and allowed to stand on the table, so that the air bubbles will come in, then the glass cover is put on and then screwed up, but not too tightly.

Q. While the sugar was dissolving how was the polariscope adjusted?

A. I adjusted it each time with these quartz plates that had been sent me from the Government.

Q. And the 200-millimeter tube was then placed in the instrument?

A. That was placed in the instrument and the readings made.

Q. And how many readings were made?

A. Five readings in each of these determinations.

Q. And the average taken?

A. And the average taken and the correction made.

Q. And the average difference you have stated per degree centigrade was——?

A. Was 0.0307.

Q. In making these various tests was exactly the same method pursued?

A. Yes.

Q. And the only difference was the difference in temperature?

A. The only difference was the difference in temperature; everything was the same, the same flask, the same amount of sugar, and the same 200-millimeter tube, and everything identically the same excepting the temperature.

Cross-examination by Mr. CLOSSON:

Q. When did you graduate from Trinity college?

A. 1884.

Q. What is your age?

A. 39.

445 Q. How long were you at Columbia?

A. I came from Trinity college and was there in the fall of 1885 and then in the fall of 1886.

Q. At separate times?

A. At separate times.

Q. About how long in each case?

A. I have really forgotten; I didn't stay through the year on account of ill health the first year.

Q. You were there as a graduate student?

A. I think not; I couldn't really say whether I came in the catalogue as a special student or in one of the classes; I took different courses there, and I really couldn't say whether I would be classified as a regular student or special student.

Q. Who were your instructors in chemistry?

A. Prof. Chandler was the head one, and then Prof. Ricketts—I don't think he was professor at that time; Prof. Wiechmann I think was.

Q. Who personally instructed you?

A. Among the instructors was Prof. Weichmann.

Q. Who is now present.

A. Who is now present.

Q. How long were you thus instructed by him?

A. I think both terms of the times I was there.

Q. Have you known him since?

A. Yes, very pleasantly.

Q. What is his standing as a chemist?

A. I should say that Dr. Weichmann had a good standing as a chemist.

Q. Is that as cordially as you can speak of him?

A. My relation with Prof. Weichmann was that of pupil and instructor and of the most cordial sort; he with Prof. Chandler were always conspicuously kind to me when I was at the school of mines. I have had Prof. Weichmann's book, and I should take any statements in Prof. Weichmann's book as having the weight—as coming from a good chemist.

Q. You regard him as an accurate and skillful observer, do you not?

A. Yes, sir.

Q. You testified that for some time you were in the habit of making commercial tests of sugar by the polariscope?

A. Yes.

Q. Mention one client in particular for whom you made a number of tests, mention his name?

A. The name of Pressrich.

Q. Was he in the sugar business?

A. I really don't know. Of course he was one of a good many clients of mine that sent these sugars to the laboratory to be tested.

Q. You don't know whether he was a buyer or seller of sugar?

A. I haven't the remotest idea.

446 Q. Can you explain what you mean when you state in your testimony that you make any corrections on the red scale?

A. In the front part of the polariscope are the two scales, one is the black scale and the other is the red scale, called so from the colors that are on those scales. The black scale is the one that is used for the reading of the percentage of sugar in the solution that is being tested, whereas the other, the red scale, is used for the adjustment of the polariscope before the readings are made; that is, you put the black scale at the zero mark, and looking through the instrument there may be variations between the two shadows and

those variations or differences in the shadows is corrected by the red scale, that is, the whole sphere is brought so that each hemisphere is of the same density; and after that adjustment on the red scale is obtained then the red scale is left severely alone, and the readings made with the black scale.

Q. The first experiments to which you have testified were made at the temperature of 10° C.?

A. I think the 23° C. was made first, or may be the 10° C.; it is a matter that is immaterial.

Q. Can you refresh your memory by reference to some memorandum that you have in your possession?

A. Yes, sir.

Q. Will you look at that (referring to a small memorandum book) and see whether you can state which you made first?

A. The 10° C. was made January 30, and then the 23° C. was made February 7th.

Q. In the same room?

A. Yes, these experiments were conducted in the room that I had adjoining my laboratory; it was a large room; and the temperature before the readings, the same temperature was maintained as at the reading for I think about eight hours, may be a little longer than that.

Q. In each case?

A. In each case.

Q. How did you obtain the 10° C.?

A. That was obtained on a cold morning, and the temperature went down so that it was—so that it stayed at the 10°; the windows were open; the sun doesn't shine on that room.

Q. That was the normal temperature of the outside air on that day?

A. I should say it would be a little higher in the room; I obtained the temperature from the outside air.

Q. And the windows remained open during the whole of these eight hours?

A. They remained open during the whole of the eight hours. The test was made in a short time relatively.

Q. At what hour of the day?

A. I think that was made, if I remember rightly, in the early morning; in was in the neighborhood of nine o'clock.

447 Q. Do you mean then that the room had been exposed to the atmosphere during the previous night?

A. Yes, sir.

Q. When did you make the solution on this occasion?

A. I made the solution in the room there.

Q. When?

A. Then and there, just before taking the observation; it was all done as an analytical chemist would make a test.

Q. We don't know how that is; instead of saying that it is done as an analytical chemist would do it, won't you state exactly what you did do?

A. The analytical test is simply made as I described, by weighing out——

Q. You have already stated as fully as you need to?

A. I should say I have covered it.

Q. And you have mentioned all the material features of the experiments as you conducted them?

A. I should say so.

Q. How long have you had this polariscope in your possession?

A. Since 1896.

Q. Whose manufacture?

A. Schmidt & Haensch.

Q. At what temperature was it graduated?

A. At 17.5° C.

Q. You made five readings on the first occasion, on January 30th?

A. Yes.

Q. Will you give me each reading?

A. They are the same in each case?

Q. All five were identical?

A. All five were identical.

Q. Have you contemporaneous notes of the readings with you?

A. Yes, sir.

Q. Will you let me see them please? (Witness produces small memorandum book.)

Q. How long an interval of time was occupied in taking those five readings?

A. I could not say accurately; it might have been done in five minutes; it might take a little longer than that; it certainly wouldn't take a long time; it might be shorter than that.

Q. I observe that the second and third readings were originally noted by you here as 100.3?

A. If it is, it is an error in transcription.

Q. Your memorandum shows that the "2" has been substituted for the figure 3?

A. That is an error of transcription. Those are notes of the original experiments.

Q. But they are not the original notes?

448 A. No; the original note book I had a lot of material in it which doesn't concern this case.

Q. Have you that with you?

A. No, sir, I have not; that is a part of the laboratory equipment.

Q. And the change from the "3" to the "2" in each case was made to correct an error in transcription?

A. An error in transcription.

Q. Do you notice that the total of the five readings is stated here to be or to have been originally 100.24?

A. I am sure that is an error that I can't account for.

Q. That couldn't have been made by any error in transcribing?

A. I think very likely, for the reason that I probably got the wrong page and copied the wrong reading of another temperature.

Q. What is the figure, .08?

A. That is the correction for the flask; the flask was not the Mohr flask.

Q. What was it?

A. That correction would make it the true Mohr.

Q. What is your reason for making that statement?

A. Because it contained instead of 100.23 CC., it contained 100.31, I should say, and then that correction had to be subtracted from that.

Q. Why is the correction .08 instead of some other?

A. Because the flask is too large for a true Mohr flask.

Q. How did you get the .08 as the correction?

A. Because the Mohr must contain 100.23 CC., and this one contained more CC., that is all.

Q. Did this contain 100.31?

A. Yes, sir.

Q. Did the flask contain 100.31 metric cubic centimeters?

A. These are all the metric system.

Q. You can answer the question?

A. Yes, it did.

Q. The last figure in this record of your experiments read originally 100.16?

A. Yes, it did.

Q. That has been changed to 100.12?

A. Yes.

Q. In order to correspond with the change in the subtrahend?

A. Yes.

Q. At whose request were these experiments made?

A. At the request of the Government.

Q. From whom did the request come on the part of the Government?

A. It came—I could not say who signed the letter, the letter authorizing me to go ahead with these experiments; it came
449 from one of the special agents of the Treasury Department, if I remember correctly.

Q. At the time you made these experiments had you read the paper of Dr. Wiley's on the subject?

A. Yes, sir.

Q. What paper was that?

A. It was a paper appearing in the Journal of the American Chemical Society.

Q. The argument in that paper was to demonstrate that a correction of .03 for each degree centigrade was necessary in order to insure readings by the polariscope?

A. Yes, sir; that is the correction for readings about 17.5°.

Q. Taking 17.5° as the normal temperature?

A. Yes.

Q. You understood Dr. Wiley's idea to be a correction of .03 for each degree centigrade?

A. Yes, sir, that is what I understood.

Q. At what time of day were these experiments taken on February 7?

A. That I have forgotten; I couldn't say; it may have been in the morning; it may have been in the afternoon.

Q. Was that the normal temperature of the air on that day?

A. No, sir; that was obtained by steam heat in the room, that is, the radiator.

Q. 23° C. is equivalent to about 75?

A. I think it is higher than that; I guess it is about 80; if it is material I can ascertain it.

Q. You were wholly unable to state at what time of day those readings were taken?

A. I cannot state what time of day that reading was taken.

Q. What precautions had you taken to keep the temperature at that point for any length of time prior to the readings?

A. By watching the thermometer when I came down in the morning, looking at it from time to time. The room was shut off from the main part of the laboratory and the walls are fire-proof walls.

Q. You do remember watching the thermometer in the morning?

A. Yes, sir.

Q. Then don't you remember that these readings were taken in the afternoon?

A. I really couldn't say; I should say they were taken before noon.

Q. They may have been taken in the morning?

A. They may have been; I should say they would be taken as not early in the morning; I really couldn't say.

Q. When do you usually reach your laboratory?

A. About a quarter past nine.

Q. And it was about that time on this day?

A. It might have been earlier on account of this.

Q. It might have been, but you have no recollection about it?

450 A. I have not.

Q. You made no readings in the course of these experiments between those two temperatures of 10° and 23° C.?

A. Yes, I made quite a number of readings.

Q. In the course of these experiments?

A. In the course of these experiments.

Q. Have you the results of them here?

A. Some of them are noted in that book that you have (memorandum book of witness above referred to).

Q. Will you show me the record of any of them in this book? (Witness refers to page 7 of that book.)

Q. These figures show various changes from what they were originally entered at, do they not?

A. Yes.

Q. The first one has been changed from 99.90 to 99.98, has it not?

A. There is again the same remark that I applied to the other case.

Q. You were unfortunate in transcribing them?

A. I made it in transcribing from one book to the other in two cases.

Q. And the second reading which now reads 100.0 read originally 99.9, did it not?

A. You say read originally; it was entered originally; the error is entirely one of transcription.

Q. The entry which was originally 99.9 was changed so as to read 100.0?

A. The entry in copying was made that; an error in transcribing from one book to another is one that can be made.

Q. But I am not asking you about the error in transcribing; I am asking about the change?

A. There is a change in this book.

Q. And is that which I have described from the figures?

A. I believe so.

Q. The third reading was originally entered as 99 and now reads 100, does it not?

A. If there was a correction in one place there might be all through the original copies.

Q. Yes, but would you mind answering the question?

A. I answer, yes.

Q. And the figures entered as the average of these five readings was originally entered at 79.98 and now reads 99.98?

A. The readings in this case is 99.98 as it now reads.

Q. What was it originally?

A. The second reading is 100, the right reading, the third is 100, the fourth is 100, and the fifth is 100; the average is 99.98; the correction is 0.08, and the corrected reading is 99.9.

Q. Now, will you mind answering the question whether
451 or not the figures which now read as the average 99.98 originally read 79.98?

A. No, sir; that is my way of writing a *9*. The start of the *9* goes around on the inside of the opening of the figure *9* and makes it look at though it might have been a figure *7*.

Q. Then it was not a *7*?

A. It was not. The same thing you can see further up; that is the way that I make my 9's.

Q. Those are readings taken by you on a day prior to the first about which you testified on your direct-examination?

A. I think the date is January 27; it seems to have been.

Q. Are there any other entries in this book of other readings taken by you during the course of these experiments at or about this time?

A. Yes; the reading on January 29 is another one.

Q. These were taken at a temperature of 23.5° C.?

A. Yes, sir.

Q. And the five readings were 99.7, 99.8, 99.7, 99.8, 99.8, making an average of 99.76, corrected by subtracting .08, giving an average of 99.68?

A. Yes, sir.

Q. Will you show me other entries of experiments?

A. No, I have no others here.

Q. The only corrections which you have spoken of as having made from the readings actually observed by you, were the original correction on the red scale and the correction of .08 for the flask —those were the only corrections made by you from the actual readings as you saw them with your eye?

A. Yes, sir.

Q. What figure represents the error in observation? There is a possible error of observation, is there not? Is it possible to obtain exact accuracy in readings?

A. They would be different with different people, according to the eye. You mean the reading between the half shadow?

Q. Two equally accurate observers may make the same record seem differently?

A. Yes, sir.

Q. What is considered the permissible limit of variation?

A. Imagine the case of one making a reading and then another one reading, and then if there is a variation it might be a tenth; I don't think it ought to be more.

Q. Do you know what the Government regulations prescribe?

A. I do not.

Q. Would you be surprised to learn that they permit a variation of .2?

A. No.

Q. At what temperatures are commercial readings with the polariscope made?

A. As near the 17.5° C. as the case might be.

452 Q. But they might go below that?

A. If the fire went out in the stove it would be.

Q. That is not supposed to happen?

A. That is not supposed to happen.

Q. As a rule they are made at a temperature about or near 17.5° C.?

A. Yes, as near 17.5° as may be. Of course on warm days it might be at a higher temperature.

Q. Have you in your practice as a commercial chemist made readings for commercial purposes at temperatures below 17.5° C.?

A. I would not do so; if the fire went out I would not want to make the reading.

Q. And they are not made in practice?

A. I could not speak for other chemists. I don't think it would be natural to make them under abnormal circumstances.

Q. And a reading below 17.5° C. would be abnormal, would it not?

A. I wouldn't make them myself.

Q. Are you still engaged in making commercial tests for the trade?

A. I am not for the present; I am retained by some comporations which take practically all the time that I have.

Q. Since when is it that you have ceased to make commercial tests?

A. Since May.

Q. And up to May last how long had you been engaged in making commercial tests?

A. Between three and four years.

Q. And were you in the habit while making those commercial tests of applying this correction of .03?

A. No, sir.

Q. Where did you obtain the samples of sugar which you tested in these experiments for the Government?

A. The particular sample was sent me from Washington.

Q. Was it Dr. Wiley who sent them?

A. It was from the Agricultural Department; I couldn't swear as to who sent it.

Q. Dr. Wiley is at the head of that?

A. Yes.

Redirect-examination by Mr. PLATT:

Q. The memorandum book that you have here, are these entries the original entries of these readings?

A. No, sir; they are copies.

Q. The original entries are in the laboratory book?

A. Yes, sir.

Q. And do these figures here as corrected, to which your
453 attention has been called by counsel, agree with the figures in the laboratory book?

Mr. CLOSSON: I object on the ground that the laboratory book is the best evidence of that fact, and I invite the witness to produce it.

Q. Your attention has been called to what the counsel has said are corrected figures; they are not the original entries in this book?

A. No, sir.

Q. These figures to which your attention has been called, are they correct copies of the entries in the laboratory book?

Mr. CLOSSON: I renew my objection, on the ground that the question calls for secondary evidence, and the best evidence is the laboratory book itself.

Objection overruled; exception.

A. These were copies from the original entries, and the one where there are corrections in this book I have noted in full in reply to the question where I gave the full details.

Q. So as they stand there they are correct transcripts of the correct figures in the laboratory book?

Same objection, same ruling, and exception.

A. Yes.

Q. You spoke about Dr. Wiechmann being one of your instructors; has he written some book or books?

A. Yes.

Q. Have you read those?
A. I have.
Q. Does the doctor state anything in those books in relation to the influence of temperature in the polarization of sugar?
A. In his book on "Sugar Analysis"—I do not know which edition it was, but it was page 34 of the edition which I have—he speaks about the fact that it is well known, if I am quoting correctly, that temperature does influence polarization.

Adjourned without fixing date.

454 United States Circuit Court, Southern District of New York.

No. 2918.

BARTRAM BROS.
vs.
THE UNITED STATES.

No. 2919.

BENJAMIN H. HOWELL, SON & CO.
vs.
SAME.

No. 2920.

THE AMERICAN SUGAR REFINING CO.
vs.
SAME.

Hearing resumed February 26, 1901.

Before Hon. William B. Howell, as officer of the court.

Appearances.

For the importers: H. B. Closson and A. K. Tingle.
For the United States: Henry C. Platt, ass't U. S. attorney.

HARVEY W. WILEY, recalled as a witness on behalf of the United States, testified as follows:

By Mr. PLATT:

Q. Doctor, since you were last examined in this case have you attended the meeting of the International Commission for Uniform Methods of Sugar Analysis?
A. Yes, sir.
Q. That was held in Paris, July 24, 1900, was it?
A. From memory I couldn't recall the date; it was along about that time. It was July 24, 1900 (refreshing his memory from a phamphlet).

Q. What was that commission, Doctor? What was the nature of their meeting?

A. It was the third meeting of an international commission, which was appointed, I think, in 1896, to study the international methods of analysis of sugar. I can't recollect the circumstances of its appointment; I only know that I was selected as one of the members from this country at the time and have been a member of the International Sugar Commission ever since as a delegate from the State Department and for the Department of Agriculture at Washington.

Q. Any other chemists from this country?

A. Dr. Wiechmann is also a member of this commission.

Q. Dr. F. G. Wiechmann?

A. Yes, sir.

455 Q. The same gentleman that has been examined as a witness in this case before the board?

A. Yes, sir; the very same.

Q. Was the question of the influence of temperature in the use of the polariscope in the testing of sugar discussed before that commission?

A. It was.

Q. Who were present as the delegates from the various countries?

A. Dr. Herzfeld of Berlin was there as president, one of the members from Germany; and Mr. Sachs of Belgium was present as a delegate from Belgium; Mr. Strohmer of Vienna was one of the delegates from the Austro-Hungarian Empire; and the two gentlemen whom I have mentioned as delegates from this country were present; Mr. Winter of Java was there; Prof. Brodhun of the Imperial Technical Institute of Charlottenburg was present, and a number of other gentlemen whose name I don't recall but whose names are published in the list there in the paper which you hold.

Q. Were the proceedings of the third session of the International Commission there reported and printed?

A. A résumé or abstract has been printed in three languages.

Q. Signed by the secretary?

A. A secretary was appointed for German and for French and for English, to prepare the abstract for publication.

Q. It was published in French, English and German, was it?

A. Yes.

Q. In parallel columns?

A. Yes, sir.

Q. I show you a printed paper; is that the report of the proceedings to which you refer?

A. Yes, this is the abstract containing a report of the proceedings.

Mr. PLATT: I offer this abstract in evidence.

Said abstract received in evidence and marked "Ex. H, for Gov't."

Q. Doctor, for convenience of the record, can you refer us to any part or parts of that report that refer to this subject-matter under consideration?

A. The first business before this commi-sion was in listening to a paper which I presented on this subject, in essence containing the result of my work which I have already testified to before this court. The next was a paper by Dr. Wiechmann, of which I have a copy here on the same subject (producing a pamphlet); that followed my paper.

Q. This is the same gentleman whose testimony is in this record (referring to testimony taken before board of appraisers)?

A. Yes, sir.

456 Mr. PLATT: I offer in evidence this pamphlet, by Ferdinand G. Wiechmann, on "The question of temperature influence on the specific rotation of sucrose," it being a copy of the paper read at this meeting.

Said pamphlet received in evidence and marked "Ex. I for Gov't."

The WITNESS: The two papers were followed by a discussion, which was engaged in by different members, several members of the commission. In the abstract (Ex. H.) there is only a reference to the remarks of Prof. Bordhun, of Berlin. Prof. Brodhun's remarks were based on some statements in Dr. Wiechmann's paper criticising the methods employed in the Imperial Physical Reichsanstalt at Charlottenburg (translated it is the Imperial Physical Institute at Charlottenburg), in which Dr. Bordhun explained that the criticisms offered by Dr. Wiechmann could not obtain as the work had been done with every possible care to avoid the very errors which Dr. Wiechmann said might have entered into the work. This was followed later on by a resolution offered by Mr. Sachs, of Belgium, the original text of which is printed on page 6 (of Ex. H) in French; this report and the translation is found in Dr. Wiechmann's digest in a parallel column; the translation is not literally word for word, but contains essentially the principal of the original resolution. This resolution recommended, first, that polariscopes should be graduated at a temperature of 20° C. instead of 17.5° C., which is the usual temperature for the German instruments, those in common use at the present time. This resolution was unanimously adopted. The next was in regard to the normal weight to be employed and the size of the flask; the resolution was that a 100 metric flask be used with a normal weight of 26 grams, but during the period of transition from the old standard to the new standard it was permissible to use the Mohr flask and a normal weight of 26.048 grams, sugar in each case to be weighed in air with brass weights. This resolution was also carried with unanimity. The next part of the resolution referred to countries where the temperature differed greatly from 20°, that in those countries the polariscope might be graduated for the normal temperature as near as possible in countries using it either 25° or 30° or any other temperature which was nearest the normal for that country; and in all cases, whatever be the standard of gradu-tion, that the temperature of the solutions of the sugar and the temperature of polarization should be at or approximately near the standard at which the instrument was graduated. Those three points cover the essence of the resolution of Mr.

Sachs, and all these were adopted unanimously, as the sense of the commission. I will state that only one member, Dr. Wiechmann, took the ground that temperature had no influence on polarization; and when Dr. Wiechmann quoted Dr. Herzfeld as being of his opinion, Dr. Herzfeld rose and said it was a mistake, that he was not of that opinion, but belonged to the other side of the case.

457 Q. Is there any other particular portion of that report referring to the matter here in controversy as to the influence of temperature upon polarization?

A. No. The other part referred to the method of preparing pure sugar and that pure sugar should be taken as the standard of polarization.

The resolution of Mr. Sachs, above referred to by the witness, was as follows:

"In general all sugar tests shall be made at 20° C.

The adjustment of the saccharimeter shall be made at 20° C. One dissolves (for instruments arranged for the German normal weight) 26 g. of pure sugar in a 100 metric cubic centimeters (or during the period of transition, 26.048 g. in 100 Mohr's cubic centimeters), weighing to be made in air, with brass weights, and polarizes the solution in a room, the temperature of which is also 20° C. Under these conditions the instrument must indicate exactly 100.00.

The temperature of all sugar solutions to be tested is always to be kept at 20° C. while they are being prepared and while they are being polarized.

However, for those countries, the temperature of which is generally higher, it is permissible that the saccharimeters be adjusted at 30° C. (or at any other suitable temperature), under the conditions specified above, and providing that the analysis of sugar be made at that same temperature."

The WITNESS: The other part of this abstract (Ex. H.) refers to the method of preparing pure sugar, the method being given with the recommendation that it should always be prepared by some one official body in each country and not left to the individual chemist, on account of the difficulty of securing pure sugar; and that in those cases where the chemist was so situated that he could not have access to the pure sugar prepared by the central standard body, that he should graduate his polariscopes with quartz plates standardized by the pure sugar solution of the central body. That was the essence of the rest of the matter referring to the standardization of the instrument. It was also stated in the commission that Prof. Pellat, who was to read a paper before the commission on "the influence of temperature on specific rotation," was detained, but that he would read his paper before the sugar section of the Fourth International Congress of Applied Chemistry at a certain date, and it was voted that the commission attend as many as could the reading of this paper. I was one of those who attended at the time and heard Prof. Pellat read his paper; and have here a statement copied for the commission of what he says in regard to the matter of "Influence of temperature on the specific rotation of sugar—paper read before the

4th *Congres International de Chimie Applique*" (4th International Congress of Applied Chemistry), "by Pellat." *"Revue Gene-*
458 *rale des Sciences pures et appliquees.* Special report of the 4th *Congres International de Chimie Appliquee,* p. 12." This is the result of his investigations: (reading) "If in a glass tube a rotation p is obtained for a temperature t between 16° and 24° the rotation which one would have obtained if the tube had been at 20° is given by the following formula:

"P20=P [1+0.00036] (t — 20)]."

Q. You have not got a full copy of that lecture here?

A. No, I have not; I have only the abstract.

Q. And that abstract you have just given?

A. Yes.

The WITNESS: This formula of Prof. Pellat gives an influence for rotation somewhat higher than that obtained by Prof. Schonrock and by myself, somewhat greater, making for 10° C. .36 of a degree of sugar.

Q. Have you read Dr. Wiechmann's pamphlet there on that subject?

A. I heard it read in the first instance; then I have read it very carefully once or twice since.

Q. Have you also read his testimony taken in this case or heard it?

A. I have heard his testimony and I have also read it since.

Q. Do you desire to call our attention to any specific part of that paper (Ex. I) of Dr. Wiechmann's?

A. In this paper Dr. Wiechmann introduces a correction for temperature in his polarizations, particularly on pages 33, 34, 35, 36 and 37 in his paper (Ex. I). In this paper he finds that a solution of sugar made up and read at a given temperature, say 20°, and then made up and read at another temperature, as, for instance, 32.5°, gives a different polarization. That is on pages 33, 34, 35, 36 and 37. The particular data to which I refer are as follows on page 34: The direct polarization of sugar was 99.57 at 20°. On page 36 the direct polarization of the same sugar at 32.5° was 99.39, to which Dr. Wiechmann added a correction of 0.19, bringing it back practically to the original polarization, following exactly the method which I employ, although he didn't add so large a correction, but the principle is exactly the same, the correction being a little over half as large as I would have added in a similar case.

Q. On page 32, Doctor, in relation to the question of temperature on specific rotation of sucrose in that pamphlet (Exhibit I) what does Dr. Wiechmann say:

A. On page 32 he says, in the third paragraph from the top (reading): "This would seem to be satisfactory evidence and sufficient to establish the conclusion that—Jobin's correction being applied—solutions of a pure sucrose prepared at various temperatures and polarized at the temperatures at which they have been prepared, will return identical polarizations."

Q. What is the Jobin's correction referred to there?

A. The magnitude of that correction is given on page 33,
459 and also a reference to the German translation of Jobin's paper, which, however, is not a complete translation of the paper, a large part of it being omitted, but the formula is exactly right; I have consulted Jobin's original paper, and the formula given by Dr. Wiechmann is exactly the one given by Jobin himself. It makes a correction of .16 for each ten degrees of temperature. Jobin himself said in the meeting, as quoted in this report here (Exhibit H) on page 3, "that he himself had not made personal investigations regarding the influence of temperature on polariscopic instruments, he referred solely to his earlier publication on this subject as well as to the coming lecture of Mr. Pellat," who developed the .3, as I have described before.

Q. You have called our attention to portions of that report, Exhibit H, that have reference to this subject-matter, have you not?

A. Yes, to all that have reference to this point.

Q. Is there anything further, Doctor, that you can state here that has reference to this point in controversy that took place there except as you have already stated?

A. I would state that Prof. Schonrock has published since his first paper another paper, of which I have copy or an extract from, in which he fully confirms his earlier work.

Q. Was he one of those delegates?

A. His superior officer, Dr. Brodhun, was a delegate. Dr. Schonrock edited the work of the *Physikalisch-Technischen Reichanstalt.* He says (reading): "In view of the continuation of the discussion among sugar technologists and in view of the practical importance of the influence of temperature on the specific rotatory power, upon which a report was made in the *Thatigkeitsbericht* for the year 1896, another series of experiments has been made with a new polarization tube; and with the purpose of extending the temperature interval so that the requirements of sugar technology would be completely satisfied. The new results confirm the previous ones in every particular." And then he repeats the formula, which is exactly the same as he gave before, showing that the influence of temperature amounts to .217 for each 10° upon the specific rotation, and his temperature has now been extended from 10° to 32°; the temperature co-efficient is 0.000217 and is correct to 0.000009 plus or minus. It is also published in the *Zeitschrift des Vereins der Deutschen Zucker-Industrie,* for 1900, pages 413 to 434.

Cross-examination by Mr. CLOSSON:

Q. What is the name of this congress or meeting to which you have referred?

A. Of the commission or the congress?

Q. I did not know that there were two bodies.

A. One is a committee of the other.

Q. The one that passed the resolution to which you have referred?

460 A. That is the International Commission for the Unification of the Methods of Sugar Analysis.

Q. Was it at a meeting of that commission some three or four years ago at Vienna that your paper, already in evidence here, was read?

A. I read my paper, which was afterwards offered in evidence here.

Q. At a previous meeting of the same body?

A. I did not read the paper in full before that. I read the paper before the Third International Congress of Applied Chemistry in Vienna. I didn't read it before the sugar commission at that time; I read it before the Third International Congress of Applied Chemistry.

Q. Was there a meeting of the sugar commission at Vienna at that time?

A. Yes, there was, but they didn't discuss this question.

Q. Now, at the meeting of this same commission in Paris in 1900, do I understand that you, Dr. Wiley, read a paper before the commission on the question here as to the influence of temperature on the rotatory power of sucrose?

A. Yes, sir.

Q. Have you produced to-day a copy of that paper?

A. No, sir.

Q. Have you it with you?

A. No, sir.

Q. It has been published, has it not?

A. It was published practically before I read it. The paper I read was essentially the paper I published in the Journal of the American Chemical Society about two years ago.

Q. Has not the paper as read before the commission in 1900 been published somewhere?

A. No, sir, not to my knowledge.

Q. And you have not a copy of it here?

A. No, sir.

Q. But it is essentially the same as another paper?

A. Yes, which has already been offered in evidence here.

Q. Has an extract from that paper, do you know, been published in the "Sugar Beet," a trade paper?

A. Possibly; I have not seen it.

Q. Who were the secretaries of this commission that met in Paris in 1900?

A. Dr. Wiechmann was secretary for the English, and Mr. Saillard for the French, and I think Mr. Herzfeld himself, the President, edited the German text.

Q. As I understand it, you read your paper, of which you have not a copy, and then Dr. Wiechmann read his paper, of which you have produced a copy?

A. Yes, sir.

Q. At that same session was there some discussion as to the method to be recommended by the commission in sugar analysis?

461 A. Yes, sir.

Q. At the same session, before an adjournment was taken, was there any action by the commission?

A. I don't remember whether the action was taken before the first adjournment or not. There was a final action.

Q. Did you introduce some resolution formulating the method that you recommended for adoption?

A. Yes, sir.

Q. Immediately after the reading of your paper?

A. I think at the end of my paper, as a part of the paper, I think I offered a resolution.

Q. And do you not now recollect that without acting on that resolution the commission took a temporary adjournment?

A. I think perhaps they did; I couldn't say positively.

Q. And either later on in the same session or after the adjournment the subject came up again, did it not?

A. Yes, sir. Mr. Sachs came to me and asked me to withdraw my resolution and accept the one which he had prepared; and I said as it covered exactly the principle which I had contended for I should be very glad to do so.

Q. This was after the recess?

A. I think perhaps it was; I wouldn't be positive.

Q. Have you a copy of the resolution which you prepared?

A. No, sir, I have not.

Q. Was your resolution in writing?

A. It was at that ime.

Q. Do you know what became of it?

A. I left it with Prof. Herzfeld, as the president of the proceedings of the association.

Q. Then, later, as I understand, you withdrew your resolution and agreed to the adoption instead of one proposed by Prof. Sachs?

A. Yes, sir.

Q. And that was the resolution which you say was unanimously adopted?

A. Yes.

Q. You and Dr. Weichmann both concurred in it and which appears in the printed report?

A. I voted for it myself and Dr. Weichmann certainly didn't vote against it; it was said to be unanimous; there was no contrary voice.

Q. Did you not, Dr. Wiley, propose an amendment to Dr. Sachs' resolution or suggest an alternative method to the one proposed in his resolution?

A. No, sir; my resolution was offered first.

Q. You offered a resolution first, a resolution covering the same ground, but did you not later suggest to Dr. Sachs' resolution an amendment suggesting an alternative method? Do you recollect that?

A. I said something about the difficulty of using pure
462 sugar prepared by every one in standardizing instruments, and suggested that quartz plates be used which were themselves standardized with pure sugar.

Q. Did you suggest that as an amendment to Dr. Sachs' resolution?

Q. Is yours one of the larger offices? Do you do a large part of the business?

A. I have got some importers here.

Q. Isn't it a fact that you do about a third of all that business here in the city?

A. Possibly.

Q. You wouldn't deny it at any rate?

A. No, I couldn't affirm either. I really don't know what quantity exists.

Q. During all this period that you have been testing sugar by the polariscope for commercial purposes have you followed one uniform and unvarying method?

A. Yes, sir.

Q. Will you describe it?

A. I take my sample, prepare it; I may mix it or prepare it, take it to a scale, weigh out exactly 26.048 grams of sugar, take the sugar and pour it in the flask, Mohr's flask, dissolve that sugar, shake it, after the sugar is dissolved I clarify my solution by putting in some acetate of lead; I fill then my flask up to the mark, 100-mark, shake thoroughly, filter solution through a dry paper filter, and take some of the clear solution, fill the tube of 200 millimeters, and put it into the instrument for polarization.

Q. Then you take the reading of the instrument?

A. Then I take the reading of the solution prepared that way.

Q. Do you make any corrections or additions to or subtractions from the readings as you observe them in the instrument?

A. No, sir; except the instruments if they are high or low.

Q. If the instrument is in adjustment?

A. The adjustment is taken before and if the instrument is found to be correct I do not.

Q. Have you practiced this method of testing sugars in other countries than America?

A. In Cuba, in Germany.

Q. Can you state whether or not the method which you have described as followed by you in the trade is that followed by other trade chemists in the United States, in Germany and in Cuba?

A. I think so.

Q. What do you know about it?

A. Of course, in Cuba I had very little occasion to meet other chemists, since I was in a town where I was the only chemist practicing there.

464 Q. Is the method which you described in use to your knowledge in Europe?

A. Yes.

Q. Do you know of any other method which is in use by commercial chemists in Europe?

A. No, sir.

Q. Do you know of any other method in use by commercial chemists in this country?

A. No, sir.

Q. Have you ever used any other method?

A. No, sir.

Q. Have you ever made or ever heard of any other trade chemists making, either in Cuba or in this country or in Europe, additions or subtractions from the reading of the polariscope, due to the supposed influence of temperature upon the solution?

A. No, sir.

Q. Do you know the method which is now in use in the United States laboratory for testing sugar by the polariscope?

A. I have heard of it.

Q. What is it, so far as you understand it?

A. Of course I understand the United States has adopted a method of polarizing sugars, which being about the same as the method I use, except making a certain addition or amount, which has left my memory, added to the polarization if the temperature of the room goes above the temperature at which the instrument has been standardized.

Q. Do you know of any trade chemists here or in Cuba or abroad who follow that method now in vogue in the United States laboratory?

A. No, sir.

Q. From your experience in the business, is such an addition to the actual reading observed by the polariscope necessary or proper in order to obtain the correct test of the sugar?

A. No.

Cross-examination by Mr. PLATT:

Q. You think the temperature has nothing to do with it?

A. No, sir.

Q. In whose employ have you been in making these tests of sugar?

A. Importers, for instance; New York sugar men, of Philadelphia, Boston; whoever sends samples.

Q. Were you ever employed by the American Sugar Refining Company?

A. No, sir.

Q. By B. H. Howell, Son & Co.?

A. Never been employed by Howell.

Q. Bartram Brothers?

A. No.

465 Q. Well, by whom have you been employed; give us some of the names of the importers?

A. For Mr. Lueder, 112 Wall street; I made tests for him. McDougall, same building; I made some tests for them. I made some tests for Stanhope, 96 Wall street, as much as I remember, and several others; James Lee; Nevers & Callaghan sent some work to me.

Q. What was the object of your making these tests?

A. To ascertain the quantity of sugar in the samples.

Q. For what purpose?

A. I suppose to ascertain the value of the sugars.

Q. That was the chief object?

A. That was the chief object.

Q. What do you mean by the phrase "commercial chemists"?

A. A commercial chemist is a chemist that is employed in the trade or to the trade.
Q. In the sugar trade?
A. Sugar.
Q. Exclusively?
A. Not exactly; but the trade.
Q. By any trade?
A. By any trade.
Q. Are all chemists commercial chemists?
A. If they are in the position I am I suppose they are.
Q. Did you ever teach chemistry?
A. No, sir.
Q. Where did you graduate?
A. In Leipsic.
Q. From what institution?
A. There is only one institution there, the University of Leipsic.
Q. When?
A. In 1881.
Q. What do you know about the methods of other chemists in testing sugar by the polariscope?
A. I don't understand what you mean.
Q. What do you know of the methods used by other chemists in testing sugar by the polariscope?
A. I think the method they use is the same as I use.
Q. How do you know?
A. As it is described in books?
Q. What books?
A. Books giving the method for the polarization of sugar.
Q. Name some of them.
A. Freuleigh & Schultz; Stammer. That is about all that I know.
Q. Those two books?
A. Yes.
Q. Do they tell you how to polarize sugar?
A. Yes, sir.
466 Q. You follow those two books, do you, or the methods stated in them?
A. The general methods, yes.
Q. Were you ever present when any other chemist tested sugar by the polariscope?
A. No, sir.
Q. And you haven't any personal knowledge of their methods, have you?
A. No, sir.
Q. What polariscope do you use or have you used?
A. I used the Schmidt & Haensch.
Q. At what temperature is it graduated?
A. It is graduated at 17.5° C.
Q. Do you know what methods the French trade chemists use?
A. Yes; they use about the same method, only use a different in-

strument; I think it is made by Laurent, the Laurent's instrument.

Q. Did you ever see any French trade chemists make tests?

A. No, sir.

Q. Is their instrument constructed on the same principle as the one you use?

A. I don't think so; I think they use a different weight of sugar solutions.

Q. Do you know what methods are used by the Belgium chemists?

A. No, sir; I suppose the French; they speak French mostly.

Q. You suppose the Belgium chemists use the French method?

A. Yes.

Q. Why do you say that?

A. Because they speak French.

Q. All people who speak the same language use the same methods?

A. I suppose they use the method of the language they speak.

Q. Have you ever made any experiments to determine the influence of temperature upon sugar solutions?

A. Yes, I have.

Q. When?

A. I think within the last three or four weeks.

Q. A recent thing.

A. Yes.

Q. What did you find? What was the result of your experiments?

A. I found that the readings of the solutions, even though made at different temperatures, were about the same, very little difference.

Q. About the same?

A. Very slight difference.

Q. At what temperatures did you try your experiments?

467 A. I made one experiment at 17.5° C.; I made another one at 25° C.; and I made another one at 30° C.

Q. And you didn't find any difference?

A. Very slight difference.

Q. Where did you make those experiments?

A. In my laboratory.

Q. What was the temperature of your laboratory?

A. The temperature I just mentioned, 17.5°, 20° and 30° C.

Q. How did you get your laboratory at those various temperatures?

A. When I wanted the higher temperatures I got the heat in the laboratory; if I wanted the lower temperature, of course I shut it off at whatever temperature I wanted.

Q. You got it down to 17.5°, did you?

A. Yes, sir.

Q. What was the exact difference between 17.5° and 30° C. in the polarizations?

A. I don't remember exactly; I sent them over to Mr. Sherer.

Counsel for the importers produces a report made by the witness of the experiments referred to, to refresh his memory.

The WITNESS (referring to paper as above): At 17.5° C. it was 99.925, at 25° it was 99.86, and at 30° it was 99.85, the average of six readings.

Q. Anybody read with you?
A. No, sir.

Mr. CLOSSON: I offer this report in evidence as part of the witness' testimony.

Q. Did you make these tests all in one day?
A. No, sir; they were made on three different days.

By Mr. CLOSSON:

Q. And the results of your readings are correctly stated in that report, are they?
A. Yes, sir.
Q. And were all of the same sample of sugar?
A. All of the same sample of sugar.

By Mr. PLATT:

Q. Who furnished you with the sugar?
A. The sample was given to me by Mr. John Sherer.

Said report as offered above received in evidence and marked "Ex. 1 for importers."

By Mr. CLOSSON:

Q. You have been asked about your knowledge of the methods followed by other trade chemists here and abroad; have you
468 not by inquiry and conversation with them ascertained whether or not they followed the methods you described?
A. In this country, yes.
Q. Did you talk with them on the subject?
A. Yes, certainly.

By Mr. PLATT:

Q. Who did you talk with?
A. My colleagues I came in contact with.
Q. Name some of them?
A. There is Mr. Weichert, Mr. Sherer, Dr. Wiechmann.
Q. Is that all?
A. Yes.

FRANK W. BENNETT, called as a witness on behalf of the importers, being duly sworn, testified as follows:

By Mr. CLOSSON:

Q. What is your business?
A. I am an analytical chemist.
Q. Where is your office?

A. 13 Broad street, Boston, Mass.

Q. Are you in business for yourself or in a firm?

A. I am associated with Prof. Sharples.

Q. What is your firm name?

A. S. B. Sharples.

Q. How long have you been practicing as a chemist in Boston in association with Prof. Sharples?

A. For about twenty years with Prof. Sharples and five years previously with Prof. J. M. Merritt.

Q. And all of that time in Boston?

A. Yes.

Q. During all this time have you been engaged in testing for the trade samples of sugar by the polariscope?

A. I have.

Q. What part of your business does that constitute?

A. About one-half.

Q. How much of that business in Boston is done by your house?

A. I guess most all of it.

Q. What is the method in use in Boston by which buyers and sellers of sugar obtain what they consider to be the value of their sugar? I mean by that by whom are the tests made and how many of such trade chemists are there in Boston?

A. I only know of two.

Q. Describe what is done?

A. As I understand, one of the buyers selects a chemist and the seller selects a chemist, and the samples are mixed at the time they are drawn from the ship or vessel; and the packages are mixed
469 into one lot for the two different samplers, the buyer's sampler and the seller's sampler; a pound box is taken out by each side, the buyers and seller, and they in turn send them either to me or the other chemist in Boston.

Q. Who is the other chemist referred to?

A. George Eyster.

Q. Either for the buyer or seller has your house for a number of years tested practically all of the sugar received at the Boston port?

A. Except beets; we test all of the beets that come in, but most of them are not tested in Boston, foreign tests, I understand, and a few jobbers they do not get; we get a majority of them, practically all goes through our office.

Q. Beginning at the commencement of the process of sampling, describe the handling that these samples of sugar which eventually come to your office to be tested undergo?

A. We receive them, sort them out according to marks, and then if the sugars are uneven at all we empty them out, mix them well and put them back.

Q. I refer to the process of taking the samples out?

A. I don't sample; I couldn't state; I never was present when they were sampling.

Q. What part of the process comes first within your knowledge?

A. When the sample comes into our office.

Q. The receipt of the box in your office?

A. The receipt of the box in our office.

Q. Describe what is then done?

A. If the sample is uneven at all we mix it with our hands on a sheet of paper or glass and then mix it thoroughly and put it back in the box, and then take that sample and weigh 65.12 grams of sugar, and put that in a quarter of a liter, 250 centimeter, flask, graduated at 62°; then that is shaken until it is thoroughly dissolved; then from one to ten centimeters of basic acetate of lead solution is added to it, according to the quality of the sugar; for molasses sugar we take ten or less cubic centimeters, and the centrifugal perhaps one or two centimeters; then that is thoroughly shaken and put on to a dry ribbed filter, which is then put into a tall glass jar and from there it is put into a 200-millimeter tube, brass tube, that we use generally, and put into the instrument, into a Schmidt & Haensch with Scheibler guarantee.

Q. Will you state the process of filling the flask?

A. I add lead and add enough water to fill the flask up to the mark, so as to hold 250 cubic centimeters, then thoroughly shaken, poured on to a dry ribbed filter, and a portion of that filtrate is put into the 200-millimeter brass tube and put in the tube in the instrument. While that is in the instrument we start another solution to filtering; while that is filtering we polarize the first solution that is in the instrument, and we keep that going right through until we get to the end of the lot of our samples.

Q. In polarizing the sugar that is in the solution do you take a note of the reading?

470 A. Take a note of the reading; adjusting the instrument, which is read every day by the standard quartz plate before we commence to polarize.

Q. And the net result of these experiments is to obtain a certain reading from the polariscope?

A. To get the polariscopic test.

Q. To that reading as you observe it upon the polarscope do you make any addition for temperature or anything of that kind?

A. Nothing for temperature. The adjustment of the instrument varies a little, which is corrected by a quartz control plate.

Q. If the instrument is correctly adjusted you make no correction?

A. No, sir.

Q. And the absolute reading of the polariscope is reported to your client as the correct reading?

A. Yes, without any change.

Q. Do you know anything of the method adopted by your rival chemist in Boston?

A. I am familiar with his method.

Q. In what respect does his differ from yours?

A. Only in using a smaller quantity.

Q. Does he make any addition to the reading for supposed errors due to temperature?

A. I am quite sure that he does not.

Q. Have you ever known of such additions being made by trade chemists?

A. I have not.

Q. Do you know that under the present regulations in vogue at the United States laboratory such additions are made?

A. I don't know; I understood they are made, but I don't know it.

Q. You do not make them?

A. No, sir.

Q. And do not know of any trade chemists that do?

A. Do not.

Q. Have you recently, at the request of some representative of the American Sugar Refining Company, made a number of readings of the same sample of sugar at different temperatures through your instrument?

A. I have.

Q. Are the results of those readings correctly stated in the paper I hand you, signed by your associate, Prof. Sharples?

A. Yes. I should say that I have not compared that with my original notes which I have here, from which these are taken.

Mr. CLOSSON: Will you please do so now.

(The witness compares said paper with his original notes.)

The WITNESS: That is correct.

Q. Your notes are identical with these figures are they, with the exception of the last correction to the last column?

471 A. Yes, with that exception.

Q. I refer to the figures in the last column reading "0.02" over "99.53"?

A. With that exception.

Mr. CLOSSON: I offer that report in evidence.

Said report received in evidence and marked "Ex. 2 for importers."

Cross-examination by Mr. PLATT:

Q. What was the highest temperature at which you made these tests?

A. A little over 30°; I started at 30°, but before I got through it was about 32° or something like that.

Q. And how low?

A. 15°, I think, or 17.5°; I think it was 17°, the lowest at which I made a test.

Q. Did they read lower at the higher temperature?

A. They did.

Q. The results are shown on this statement of yours (Ex. 2)?

A. The figures are on that paper.

Q. Who read with you—anybody?

A. No, sir; I read alone.

Q. You simply test for the buyer or seller?

A. Both; sometimes one and sometimes the other.

Q. Do you make any correction for this lower reading after reading, if you are making it for a buyer or seller?

A. I gave my readings as they were to Prof. Sharples, and I didn't notice what corrections he made there, but they agree with the readings here.

Q. In your reports you make no corrections?

A. No corrections, except where the instrument is out of adjustment for the correction with the quartz control plate. In this ins-ance there was .1 substracted from the readings on account of the instrument being .1 too high, as shown by the control plate.

Q. Why do you correct for a small error and not for a larger one?

A. I don't know as there is a larger one; we don't recognize any other.

Q. Don't this statement that you have produced here show a larger error than that at different temperatures?

A. For the different temperatures we report them just the way I read them at the temperatures without making any corrections?

Q. You don't make any corrections in your ordinary work?

A. No, sir; these tests were made exactly as we do commercial work, without any reference to anything else.

Q. Were those tests mentioned in this report of the same sugar?

A. All out of the same bottle.

Q. When you are making your tests for the buyer or seller you don't make any corrections?

472 A. No, sir; we don't make any corrections.

Q. Where did you study chemistry?

A. Wholly private tuition.

Q. You are not a graduate of any institution?

A. No, sir.

Q. Ever taught chemistry?

A. No, sir.

Q. Never tested any sugar for the Government, did you?

A. Not knowingly; at the time I didn't know it was; afterwards I did; but not knowingly.

STEPHEN P. SHARPLES, called as a witness, on behalf of the importers, being duly sworn, testified as follows:

By Mr. CLOSSON:

Q. What is your business, sir?

A. I am an analytical and consulting chemist.

Q. And you practice your profession where?

A. In Boston.

Q. What is your office address?

A. 13 Broad street.

Q. The previous witness, Mr. Bennett, is associated with you?

A. He is.

Q. And has been for how long?

A. Since 1879.

Q. How long have you been practicing your profession in Boston?

A. Well, commercially since 1871.

Q. What part of your business is represented by the testing of sugars for trade purposes?

A. We test all that come to the port of Boston?

Q. And how long has that been true?

A. I suppose it has been true for about fifteen or sixteen years.

Q. What was your technical education?

A. I am a graduate of the Lawrence scientific school of Harvard university, and was assistant for a year at the Lehigh university afterwards and for three years at Lawrence scientific school. After that I was some fifteen years a professor of chemistry in the Dental college at Boston.

Q. Are you familiar with the process of sampling sugar from the time the cargo is unloaded to the time the samples reach your office?

A. I have watched from the time the hatches were taken out until the samples were in the office.

Q. Will you describe it?

A. As sugar comes out of the vessel it is sampled with triers running into the bag; this sugar is taken out and placed into piles separately, the various marks of the vessel in different piles; this is done by both buyer and seller, they keeping their samples separately during the day; in the evening or after they are
473 ready to mix, they take and mix these two samples and mix them thoroughly.

Q. Mix them how?

A. By hand on a table. Then draw samples from them, which are sent to the various laboratories, where they are to be tested.

Q. What further handling does the sugar undergo in the laboratory?

A. There it is mixed again ready for testing; sometimes mixed, as Mr. Bennett has said, by merely stirring thoroughly in the box. The boxes we use in Boston are boxes that hold somewhat over a pound of sugar, with a tight fitting tin lid.

Q. What effect upon the sugar has this process of handling and exposure to the air which you have described, as to the difference in quality from the time it is taken out of the hold of the vessel until the time it finally reaches your polariscope?

A. The effect is chiefly the drying effect, tends to make the sugar more dry.

Q. It is subject to a certain loss of moisture during this time?

A. Yes; sometimes loses moisture, sometimes gains slightly.

Q. Will you describe the method pursued in your laboratory after you have obtained the sample for testing?

A. Mr. Bennett has already described that method.

Q. You heard his testimony?

A. I heard his testimony.

Q. Have you anything to add to or take away from it?

A. No, sir. He has had the practical handling of the sugar for years. It has been occasionally done in my presence and I have seen exactly how it is done.

Q. In the practice of your profession have you had occasion to consider whether or not temperature has any effect upon the polarization of sugar, so that the same sugar if polarized at one temperature

would test somewhat differently from what it does when polarized at another?

A. I have read a great deal of literature on the subject.

Q. Have you likewise made observations upon that question?

A. No, not personally.

Q. Have you heard the testimony of your associate as to the recent tests made by him in Boston?

A. Yes.

Q. They were conducted under your supervision?

A. They were made under directions that were given by Dr. Wiechmann to myself to follow our regular method of testing that was in use in the laboratory every day and such as we have conducted for the last 25 years.

Q. During any of the time while you have been testing sugar for commercial purposes has it been your practice to make any additions to or subtractions from the reading of your polariscope with regard to the different temperatures at which the readings were taken?

474 A. There have been no corrections made by us.

Q. What do you know about the practice of other trade chemists in that regard?

A. I know it is not done in Boston by Mr. Eyster or myself. I make out a large number of these certificates and would know if corrections were made.

Q. Can you state whether or not it has ever been done in Boston? Is that true of all the period during which you have had knowledge of the system employed by chemists in Boston?

A. The question of making this temperature correction had never been mooted in any way there until the Government issued their instructions to their chemists for temperature corrections. At that time we talked it over somewhat and concluded that we would not make any additions to make corrections.

Q. At any rate, neither before or after the issuing of these regulations has there corrections been made?

A. Not to my knowledge has there been any for commercial work.

Q. Will you state, if you please, what reasons have guided you in determining not to make these alleged temperature corrections?

Objected to as irrelevant and immaterial.

The REFEREE: I think it is proper for him to state why he arrived at that conclusion.

Objection overruled.

Mr. Platt excepts.

A. Our reasons were that we considered generally the sugars tested were tested rather higher than they really were, and to add this further correction and still further raise it would throw out the test still further.

Q. What reasons do you have in mind leading you to the opinion that sugars would usually test rather higher than they really were?

A. Because the whole handling of the sugar from the time it leaves the vessel has a tendency to dry the sugar.

Q. And thereby increase its test?
A. And thereby increase its test.
Q. Have you also taken into consideration the effect of the addition of the lead acetate?
A. I have.
Q. What is the effect of that?
A. That tends to slightly raise the test.
Q. By substituting lead for sugar?
A. By the bulk of the lead which displaces so much liquid.
Q. You are familiar with the readings obtained by your associate during his recent experiments in testing sugar at different temperatures?
A. I copied them after he obtained them.
Q. You observed that the average reading at 17° C. is 99.71, and at 25° C. 99.65 and at 30° C. 99.51?
475 A. I did.
Q. That would indicate, would it, a somewhat lower reading at the higher temperature?
A. It would indicate that.
Q. To what, in your opinion, is that difference due?
A. To the expansion of the quartz plates.

Cross-examination by Mr. PLATT:

Q. Did you make any of these readings personally?
A. I did not; I very rarely read an instrument myself if I can help it; I don't like the work on my eyes.
Q. In handling these samples of sugar sometimes you dry them and sometimes you don't?
A. We never dry them, not purposely; it is only as it accidentally happens; the temperature or the air may dry them sometimes and not in others.
Q. Can you tell us what effect the invert sugar has in the solution on polarization?
A. It depends entirely on the sample.
Q. Do you consider that an answer to my question?
A. Well, I consider it in this way, that if we have an invert sugar present in large quantities the reading of the sample will be too low. In a 99 sugar or 98 sugar the invert sugar present has practically but little influence upon the reading, there is such a small quantity present.
Q. Did you say that the lead precipitate tended to raise the reading?
A. The lead*ing* precipitate tends to raise the reading of the solution, by taking a little less water.
Q. Isn't lead precipitate larger in low grade sugars?
A. It is much larger.
Q. Isn't the amount of invert sugar greater in low grade sugars?
A. It is much larger.
Q. Wouldn't the invert sugar then correct the reading in such sugars?
A. It would correct to some extent.

GOTTFRIED LANDSMANN, called as a witness on behalf of the importers, being duly sworn, testified as follows:

By Mr. CLOSSON:

Q. What is your business?

A. I am a chemist, an analytical chemist.

Q. Where is your place of business? ?

A. My place of business is in Philadelphia; I am running the Philadelphia branch of Mr. Sherer's laboratory.

Q. How long have you been employed in that way?

476 A. I have been in Philadelphia for eight years; but testing sugars I am for 23 years in different capacities.

Q. You mean that you have in different capacities tested sugar by the polariscope?

A. Yes, sir.

Q. For commercial purposes?

A. For commercial purposes, and manufacturing purposes, and for the Government.

Q. Were you formerly in the employ of the Government?

A. Yes, sir.

Q. Where, in what capacity, and for how long?

A. I was sugar examiner for eight years in the appraisers' office, New York.

Q. During all this period during which you have been testing sugars by the polariscope have you pursued a uniform method?

A. Yes.

Q. Will you describe it?

A. I weigh 26.048 grams of the sugar to be tested, fill it in the 100 cc. Mohr flask; this is the flask that will hold 100 grams of distilled water at 17.5° C. I dissolve the sugar in this flask and after it is all dissolved I clarify it with lead acetate, fill up to the mark with water, mix the solution well, and filter it with a dry filter; the filtrate is put in a 200-millimeter tube; and the polarization made in the Schmidt & Haensch polariscope.

Q. And the reading of the polariscope you take as the test?

A. Before I make the reading I control my instrument with my quartz plate which I always have at hand; after finding the instrument to be correct I make the reading, and whatever the reading is I put down the result.

Q. Do you make any correction in the reading for the difference in temperature between that at which the reading was made and the temperature at which the instrument was standardized?

A. No, sir.

Q. Have you ever done so during your experience as a chemist?

A. No, I never did.

Q. Do you know about the practice of other trade chemists in this regard?

A. All the other chemists I have met in the laboratories where I have worked the method of testing mentioned has been followed.

Q. Was the method that you have described the one pursued in the United States laboratory while you were there?

A. That method was used in the United States laboratory at the time I was there.

Q. How much of the sugars which are imported into the port of Philadelphia does your firm test?

A. As much as I know I test at least 80 per cent.; that is simply a rough guess on that, but I am pretty sure that it is 80 per cent. that comes in, perhaps more.

477 Q. Don't you for the buyer or the seller test practically all the sugar that is imported into Philadelphia?

A. Well, yes; we are testing the sugar for the importers, practically all the sugar that is imported there.

Q. And you always follow the method you have described?

A. Always follow the method mentioned.

Q. Have you in addition to your general experience recently made some special tests in polarizing sugar at different temperatures?

A. I have recently made tests at different temperatures.

Q. At the request of Dr. Sherer?

A. Yes, sir.

Q. And have you prepared a statement of the readings which you observed at different temperatures?

A. Yes; I sent my statement to Mr. Sherer.

Q. Is the paper I now show you the report of these tests that you have made?

A. Yes, sir.

Q. Does that correctly state the method adopted by you in making those tests and the results that you obtained?

A. Yes, sir.

Mr. CLOSSON: I offer that report in evidence.

Same received in evidence and marked "Ex. 3 for importers."

Q. Where did you receive your technical education?

A. In the Technical school at Chemnitz, Saxony.

Q. You made tests at 17.5° and 25° and 30° C., did you not?

A. Yes, sir.

Q. All of the same sugar?

A. All of the same sugar; and all the tests made with exactly the same apparatus.

Q. The average test at 17.5° was 99.76?

A. Yes.

Q. And at 25° C.?

A. 99.68.

Q. And at 30° C.?

A. 99.63.

Cross-examination by Mr. PLATT:

Q. What effect has increased temperature on the polarization of the same sugar?

A. Well, if the same sugar, it will be slightly lower as expressed in this report; the test will be slightly lower.

Q. You say slightly lower?

A. Slightly lower at the higher temperature, provided of course it is the same instrument.

Q. Same instrument and the same sugar?

A. Yes, sir.

478 Q. If your instrument was .16 of the quartz plate would you make a correction before reporting?

A. Yes; I read my quartz plate before I make a test; I control my instrument by reading the quartz plate; should the instrument show it out of the way, either up or down, of course then I will make the correction.

Q. Before reporting?

A. Before putting down my test.

Q. Now, if the temperature was higher so there would be a difference of .16, would you correct that before reporting?

A. You say if the temperature was higher.

Q. If the temperature was high enough to make a difference of .16, would you make that correction before reporting?

A. No, sir; I never made a correction on account of temperature; I never did.

Q. Why do you correct in one case and not in the other?

A. I simply act as I have seen all over wherever I have gone.

Q. You just followed your usual custom?

A. Not only mine, but the custom of all the chemists that I ever met, and I have met a good many.

Q. And you make slight corrections in the quartz wedge and no corrections for temperature, however great it may be?

A. They are different things.

Q. And errors of equal magnitude, why do you correct for one and not for the other?

A. I might answer because it is the custom in the business.

Redirect-examination by Mr. CLOSSON:

Q. You have spoken of making a correction in your reading in cases where the instrument is out of adjustment?

A. Yes, sir.

Q. That is to correct an instrument, an error in the instrument?

A. Yes.

Q. If your instrument is in proper adjustment do you make any correction?

A. No, sir.

Q. The only correction that you make is to correct an instrument?

A. Yes; if it is out of adjustment.

Recross-examination by Mr. PLATT:

Q. Will heating a quartz plate up to ten degrees throw it out of adjustment?

A. You mean the quartz plate that is used for controlling the instrument?

Q. Quartz wedges?

A. I never made experiments with that effect; I couldn't

479 tell.

Q. Where did you get your quartz plate?

A. Well, some of those quartz plates generally come with the instrument.

Q. What plate is it that you use?

A. The plate I am using is a plate testing 93.4 per cent.

Q. Has it ever been tested by any competent authority?

A. I compared it with plates that have been tested by the authorities in Washington and found it to be in perfect agreement with those plates.

Q. You compared it?

A. Yes; and I have been testing it in the usual way with chemically pure sugar.

Q. How can you compare it?

A. Well, suppose I—say the test that is supposed to be correct and tested by somebody else; say that it is 96; I read on my instrument and find it to be 96. Now, I have got a plate, say it may be doubtful; it is supposed to be 95.5; if I read it and find it to be 95.5, now my plate must be correct provided the first one is correct.

Q. Then you use the same plate to standardize the instrument, do you?

A. Yes, sir; I standardize my instruments by my control quartz plates.

Adjourned to February 27, 1901, 10 a. m.

Hearing resumed February 27, 1901.

Before Hon. W. B. Howell, as officer of the court.

(Counsel same as at previous hearing.)

MORRIS HASENCLEVER, called as a witness on behalf of the importers, being duly sworn, testified as follows:

By Mr. CLOSSON:

Q. What is your business?

A. Chemist.

Q. Where is your office?

A. 101 Wall street.

Q. What special branch of chemistry do you practice?

A. Sugar analysis; sugar, raw.

Q. How long have you been testing and analyzing sugars in this city?

A. Since 1885; 16 years.

Q. By whom are you employed for that purpose?

A. All of the sugar houses essentially. Havemeyer & Elder; Howell; Arbuckle; and all those who have sugar refineries.

Q. You test for all the refineries in this city?

A. Yes; in the neighborhood; in Brooklyn, Jersey City and elsewhere.

480 Q. What proportion of the sugar reported here do you test, how much of it?

A. I think all of it.

Q. And you have been doing so for some years?

A. For 16 years, all the time.

Q. Where did you receive your technical education?

A. I first went to Switzerland in the Technical school, and afterwards I went to Berlin and then I was assistant professor in the laboratory of the university of Berlin.

Q. When you speak of testing sugars do you mean testing them by the polariscope?

A. Oh, yes. I make also analysis of the raw sugars; that means grape sugar, invert sugar, ashes and water and impurities.

Q. In testing sugar by the polariscope have you pursued while you have been engaged in business here, a uniform method?

A. Certainly, yes.

Q. Can you describe briefly what that method is; state of what it consists.

A. I get the samples in a box; I have that sugar mixed up; and then I weigh 26.048 grams; I weigh that and have that dissolved in water; I add some solution of lead, that is, subacetate of lead, according to the color of the sugar, more or less; and then I fill it up to the 100 mark, though the flasks are all marked by the hundred; and then I filter it; after filtering I pour it into two 200-millimeter glass tubes; and then polarize it.

Q. By polarizing you mean you take the reading in the instrument?

A. In the instrument, yes.

Q. What correction, if any, do you make to the reading shown by the instrument?

A. I have two quartz plates and they are all graded.

Q. Standardized?

A. Standardized. And the instrument has to show if it is right exactly the figure of the quartz plate; and if it is a little higher or if it is less I regulate that after I take those figures in the instrument.

Q. After you have thus regulated your instrument and taken your reading, what corrections, if any, do you make to the reading itself of the instrument?

A. If, for instance, my quartz plate is 96.6, and the instrument shows, when I have the quartz plate in the instrument, it shows 96.8, then I take off the figures, I take .2 off.

Q. You make a correction for the aberration of your instrument?

A. Yes.

Q. Do you make any correction for temperature?

A. No; I never have done it.

Q. After you have obtained the correct reading according to the instrument you take that reading as the test of the sugar irrespective of the temperature?

481 A. Yes; irrespective of the temperature.

Q. What do you know about the method pursued by other trade chemists? How does it compare with yours?

A. I don't know of any except from what I have heard; I never have seen anything done.

Q. So far as you have heard of the methods adopted by other trade chemists, do they or not agree with yours?
A. I heard they put .3 to the readings.
Q. Whom have you heard do that?
A. I heard that the Government does that.
Q. Do you know of any trade chemists not in the employ of the Government who make that addition?
A. No; nobody does that.
Q. Have you recently tested a given sample of sugar at a number of different temperatures?
A. Yes.
Q. To ascertain how the readings at the different temperatures compare?
A. Yes.
Q. You made these experiments at the request of Mr. Sherer?
A. Mr. Sherer, yes.
Q. And you made a written report, which is the paper that I now show you?
A. Yes, that is my paper.
Q. That paper is your report?
A. That is my report.
Q. Does that correctly state the methods that you followed and the readings that you observed?
A. Yes, sir.

Mr. CLOSSON: I offer that report in evidence.
Same received in evidence and marked "Exhibit 4 for importers."

Q. You made readings at 17.5° C., 23° C. and 25.5° C., did you not?
A. Yes, sir.
Q. And the average results of your readings at 17.5° were 99.75?
A. 99.75, yes.
Q. And at 23° C.?
A. 99.65.
Q. And 25° C.?
A. 99.55.
Q. They were all readings of the same sample of sugar?
A. Of the same sample of sugar, out of the same bottle.

Cross-examination by Mr. PLATT:

Q. What instrument did you use?
A. Scheibler; that is the color instrument.
Q. What flask did you use?
482 A. F. Mohr.
Q. Who graduated your quartz plate?
A. I had it bought and I examined it myself; I bought the quartz plate; I didn't graduate it myself; or, at least I found it in the office when I came there.
Q. It was in the office when you came there?
A. Yes.
Q. And how long had it been there when you came there?

A. Some years, I believe.
Q. You examine these sugars, test these sugars, for the importers?
A. Well, the brokers.

By Mr. CLOSSON:

Q. The refiners, you said?
A. For the refiners.

By Mr. PLATT:

Q. The refiners import, don't they?
A. Not always. There are brokers who import.
Q. Now, in your report (Exhibit 4) there is a difference in the polarization here at different degrees; to what do you attribute that?
A. To the expansion of the fluid and apparatus and everything.
Q. What causes that?
A. The increase of the heat. I made those examinations in a closed room, wooden box, in order to get at those temperatures.
Q. What one of these three polarizations in your report do you regard as the correct one?
A. The 17.5°—99.75.
Q. You regard that as correct?
A. I regard that as the correct one.
Q. Then, the instrument must have been out of adjustment at the other temperatures?
A. No, no; it expands at the same time as the others expand.
Q. When do you consider the instrument in adjustment?
A. I have it always adjusted; I never have, as long as I have had the instrument, it always has been all right.
Q. Is the sugar solution changed then?
A. In a certain length of time it will change, but not inside of a quarter of an hour, which time I want for the examination.
Q. Was the sugar solution the same in all these temperatures?
A. All the same except the temperature; the same sugar it was, out of the same sample I got from Mr. Sherer.
Q. To what was this change in the result due? Was it in the temperature or in the instrument?
A. In the temperature, and in the instrument as much as in the temperature. If you fill up a Mohr flask up to the 100-mark at 17.5° and the temperature goes up enough, if the temperature raises the water expands and it is more than 100; and if I fill the flask up at the temperature at 25° I have to put a little less water
483 in than at the other temperature or less sugar solution. That is the reason of the lower polarization.
Q. Then, this at 25°, 99.55, is not the correct polarization?
A. It is the correct polarization at the temperature.
Q. Does the sugar contain more sugar at 17.5° than it does at 25°?
A. There is more sugar solution in it.
Q. The same amount of sugar each time?
A. Yes; the solution of the sample is always the same. If I fill up the Mohr flask at 17.5° I fill more in than if I fill it at 25°.

Q. More what?

A. Solution of the sugar; because it expands.

Q. Isn't the same volume at both temperatures?

A. No.

Q. Which is the correct volume, then?

A. At the temperature you have in the room I don't consider always the correct temperature.

Q. All of these results can't be correct. Which one is correct?

A. At the temperature given each is correct.

Q. Then you get different results at different temperatues?

A. At different temperatures I get different results.

Q. At 25° would you give the result as 99.55 as the correct polarization?

A. No; if I have a standard sugar I make the solutions always at 17.5° and arrange my apparatus 17.5° and give the 99.75 as the correct one. If it is a good sugar I want to know how much it amounts to. It is often made so as to satisfy myself about the instrument.

Q. What is your instrument standardized at, what temperature?

A. At that time 17.5°.

Q. What is it now? Is there any change?

A. It may be a litle lower; but the flame in the box always makes it within half an hour that temperature.

Q. If the quartz plate showed .2 variation would you make a correction before reporting?

A. Yes, certainly.

Q. Now, if the temperature shows .2 would you make a correction?

A. No.

Q. Why not?

A. Because I regulate myself always according to my quartz plate. The quartz plate is standardized 99.6, and in the apparatus if that quartz plate is either higher or lower I put my results down.

Q. Then, if you polarized all these sugars at 25° they would show .2 less than at 17.5°, according to your report here?

A. It isn't always the case, if you polarize in summer. I can't do anything else but to go according to my quartz plate.

484 Q. (Question repeated.)

A. Isn't that a proper answer?

Q. (Question repeated.)

A. Oh, yes.

Q. Then the seller who sold at 25° would be cheated out of .2 wouldn't he?

A. The seller wouldn't think so, because he accepts that as the regular test.

Q. The question is the fact whether it wouldn't be so, not what the seller thinks?

A. He sells it, and if he is satisfied he thinks it is all right.

Q. If the seller is satisfied he thinks it is all right whatever it is polarized at?

A. Yes; he thinks it is all right.

Q. If the buyer gains and the seller loses, it would make a difference of .4?

A. Oh, no. It is always tested by two chemists and the seller looks out he don't lose anything.

Q. Why don't he lose under your figures here? Doesn't he actually lose?

A. He don't lose anything; he looks out for that.

Q. Then the polariscope is of no use to the seller at all?

A. Oh, yes.

Q. What use is it?

A. It is used to find out the seller's test. It is as a rule two or three cents higher than my test.

Q. Why?

A. It is so; I don't know why.

Q. He uses the same methods, doesn't he?

A. Yes.

Q. His chemist does?

A. Yes, he does.

Q. Why is there a difference in the result?

A. He allows for his customer every benefit of the doubt; he gives credit to his customer.

Q. That is what you call an accurate test?

A. I can tell within .1 accurate. If I find 88.55 I leave that other five off and make it 88.50. It is only required to one decimal; it often stands betwen .5 and .6 or .6 and .7, and I take the lower test.

Q. These tests made by this method average .3 apart between the buyer and seller, don't they?

A. As a rule, we are often higher than the seller; but the samples are not always alike; I am once in a while higher than the seller, but as a rule the seller is higher than I am.

Q. Then the chemist always favors his employer?

A. Within 0.05.

Q. Then as between the buyer and seller you make no corrections at all?

A. No.

485 Redirect-examination by Mr. CLOSSON:

Q. What is the effect of the increased temperature upon the quartz plate of your instrument?

A. As you increase the temperature it lowers.

Q. It lowers the reading of the instrument, you mean?

A. Yes.

Q. And what is the physical effect upon the quartz plate? As you heat the quartz plate does it change at all?

A. I never heat the quartz plate.

Q. If you take the quartz plate at 17.5° and then heat that quartz plate to 30°, what is the change in the quartz plate?

A. It expands it.

Q. And the effect of that expansion is to give a lower reading?

A. Yes.

By Mr. PLATT:

Q. Doesn't that throw the instrument out of adjustment?
A. Not at all.
Q. It reads lower and is still in correct adjustment?
A. It is in correct adjustment. If the quartz is higher I take it off the readings.

EDWARD SHERER, called as a witness, on behalf of the importers, being duly sworn, testified as follows:

By Mr. CLOSSON:

Q. You are a sugar chemist, Mr. Sherer?
A. Yes, sir.
Q. You testified in this matter before the board of general appraisers as to your experience and qualifications?
A. I did.
Q. When was your attention first called to the question of the possible influence of changes of the temperature upon sugar polarization?
A. In 1887, when Prof. Wright, of the National Academy of Sciences, spoke to me about it.
Q. You were then employed in the United States laboratory?
A. I was then in charge of that laboratory.
Q. Who was Prof. Wright and what was his relation with the Government?
A. At the time he was conducting an investigation for the National Academy of Sciences at the request of the Treasury Department.
Q. Did you and Prof. Wright at that time discuss the subject of the possible influence of temperature upon sugar polarization?
A. We did.
Q. Did you at that time reach any conclusion upon the subject?
A. We did.
486 Q. Did you both agree in the conclusion?
A. Yes, sir.
Q. What was your conclusion?
A. That there was no necessity for temperature corrections.
Q. How long have you been in the business of testing sugar by polarization?
A. I commenced the testing of sugars in 1872.
Q. But you were for a time in the Government employ?
A. I was in the Government employ from 1880 until 1898.
Q. And except during the interval while you were in the Government employ have you been professionally engaged by the trade as a chemist in testing sugar?
A. Yes, I was engaged by the trade up to the time I entered the Government service in 1880.
Q. And since you have left the Government service have you been professionaly engaged by the trade in testing sugars?
A. Since I left the service I have been connected with the Metro-

politan savings bank. I resigned from the Government service in 1898.

Q. And since you left the Government service you have not been actually engaged as a trade chemist?

A. I have not been engaged in any chemical work to any extent at all.

Q. While you were in the service of the Government, about how many samples of sugar were you in the habit of testing?

A. During the latter part of my stay in the Government service the number of samples tested per year were from 35,000 to 40,000, and very often during the busy season I read from 100 to 150 tubes a day.

Q. Do you mean that you made all these observations personally?

A. So far as reading the solutions in the polariscope were concerned. It would have been a physical impossibility for me to have done the whole work.

Q. But you made the actual readings?

A. Yes, sir; I had charge of that work while I was in the Government service.

Q. Have you recently, at the request of the importers, in this case made readings of a sugar solution at different temperatures?

A. I have.

Q. Were these tests all of the same sample of sugar?

A. Yes, sir.

Q. What was the instrument that you used?

A. It was an instrument which belongs to my brother in his laboratory; it is a new instrument, manufactured—I forget the name of the manufacturer. It is described in the report there; he told me at the time.

Q. You have made a written report of your observations, have you?

A. Yes, sir.

487 Q. That included a number of readings of this solution at three different temperatures, at 17.5°, 25° and 30°?

A. Yes, sir.

Q. And does this report correctly state the readings and the method employed by you?

A. Yes.

Q. Is this the report (handing witness a paper)?

A. It is.

Q. This report shows that your average reading of this solution at 17.5° C. was 99.80?

A. Yes.

Q. And at 25° C., 99.75?

A. 99.75.

Q. And at 30° C., 99.70?

A. Yes.

Q. That shows a difference of .1 in the test at 17.5° and 30° C.?

A. Yes, sir.

Q. To what do you attribute that difference in the test at the higher temperature?

A. To the expansion of the quartz wedges, in all probability. That difference in the case of refined sugar would be pertinent; but in the case of a raw sugar it would not be, that would be more than compensated by the clarifying agent.

Q. You refer to the acetate of lead?

A. Acetate of lead, yes; not used in the refined sugar.

Q. But in the testing of raw sugar——

A. It is necessary in order to get a sufficiently clear solution to read it in the instrument.

Q. But in these recent experiments of yours no such clarifying agent was used?

A. No, sir.

Q. Consequently there is nothing to counterbalance the difference in polarization owing to the expansion of the quartz plate?

A. Yes; that is my understanding of it.

Mr. CLOSSON: I offer this report of Mr. Sherer in evidence.

Same received in evidence and marked "Exhibit 5 for importers."

Cross-examination by Mr. PLATT:

Q. These tests were of refined sugar that you made?

A. Yes.

Q. When did you leave the Government service?

A. I resigned in 1898; in September, I think.

Q. At what temperature was this instrument graduated?

A. I was under the impression that the instrument was graduated at a temperature of 17.5 C.

Q. You don't recall the name of the instrument?

A. Upon looking at my report (Exhibit 5) I see that Peters
488 of Berlin was the manufacturer of the instrument. I know it was a very fine instrument.

Q. Which one of these, Doctor, do you consider the correct polarization (referring to report Exhibit 5).

A. I consider that each is correct at the temperature at which it was made.

Q. These were all of the same samples?

A. This was all one sample of sugar, and at the several temperatures that sample of sugar tested as given in the report, and being a refined sugar it was quite possible for that variation of .1.

Q. And the same sugar can have these three readings at different temperatures?

A. At different temperatures.

Q. Each represents the correct amount of sugar?

A. The amount of sugar changes with the temperature within those limits.

Q. You weigh out the same amount of sugar each time?

A. Yes.

Q. Then how can the sugar change with each temperature?

A. The reading of the sugar and the instrument changing by reason of the expansion of the quartz wedges. That properly represents what is called Jobin's correction for the change in the tem-

perature of the quartz wedge. My point should be explained in this way: If the Jobin correction were applied to the results found there, of course a uniform result would be obtained. I did not apply that correction and the variation is due to the fact that I did not. Of course there would be one result: Sugar would always test the same at all times, but it would test lower at a higher temperature, and the correction should be made in order to get the exact result.

By Mr. CLOSSON:

Q. You mean the correction by Jobin's formula?

A. I mean the correction by Jobin's formula. This was not made by me in giving these results.

By Mr. PLATT:

Q. Was it ever made by you in giving any results?

A. It was not considered necessary, because the difference was within the limits of the error of observation. And in the case of raw sugars which chiefly were tested by the Government chemists, the error due to the expansion of the quartz plate was fully compensated for by the concentration of the solution owing to the use of clarifying reagents.

Q. That would be a natural compensation, wouldn't it?

A. I don't quite catch the distinction of the term "natural." It would compensate for the error arising from the other source.

Q. How does it happen that raw sugar has just enough impurities to compensate for the change in temperature?

A. I said that would be sufficient. The compensation in
489 many cases of concentration of the solution due to the use of the subacetate of lead would depend upon the quantity of the subacetate of lead required to clarify the solution. In the case of a sugar containing very great impurities the concentration would be necessarily greater, because the precipitate caused by the use of the lead would be greater and it would be more than compensation for this error in this case; and in the case of a sugar containing a very small amount of impurities the amount of subacetate of lead would be very much less, the concentration of the solution would be, therefore, very much less; but in any case it would be sufficient to compensate for the error representing Jobin's correction in the case of refined sugar, where no clarifying agent was used.

Q. What compensates for the error in pure sugar?

A. The use of Jobin's correction would be compensation.

Q. But you don't use that?

A. I did not use it in giving my results there (referring to Exhibit 5).

Q. You never have used it?

A. Never considered it necessary. Refined sugars have only recently been tested to any extent by the Government.

Q. But the fact remains that you never have used that correction?

A. I have never used that correction.

Q. Well, then, technically the polarizations of refined sugar are incorrect?

A. It would depend upon the temperature at which they were made, would it not, somewhat?

Q. If it was not made at the temperature at which the instrument was graduated?

A. Within a very narrow limit, yes, sir, that would be true.

Q. Can a given sample of sugar have different values?

A. No, sir, it should not have.

Q. Then which one of these in your statement (Exhibit 5) is the correct one?

A. The one made at the temperature of 17.5°. I should like to call attention to the fact that all three are within what is ordinarily known as the limit for the error of observation, which allows for two or three-tenths of a degree.

By Mr. CLOSSON:

Q. What do the Government regulations allow?

A. The Government regulations allow three-tenths.

By Mr. PLATT:

Q. Don't errors of observation often go above as well as below that?

A. Yes.

Q. All these observations have been below as the temperature arises, have they not?

490 A. I have not considered that an error of observation; I said that it was within the limits; I have not said that was an error of observation; I consider these (referring to Exhibit 5) correct results at these temperatures; there is no correction applied to them.

Q. These are not errors of observation?

A. No, sir; it was a very careful experiment; and errors of observation were eliminated by the large number of readings made in each case, the average being taken.

Redirect-examination by Mr. CLOSSON:

Q. Does the refined sugar of commerce ever test 100?

A. No, sir.

Q. What sugar is supposed to test 100 on these instruments?

A. Chemically pure sugar, prepared by chemical processes and purifying.

Q. Is the refined sugar that is found in the trade chemically pure?

A. I should consider it impossible that it should be.

Q. Then that sugar could never test 100 on a correct instrument?

A. I think not.

Q. What is the sugar which is tested in the trade by polariscopes, raw or refined?

A. Raw sugar alone.

Q. Consequently in the tests made by trade chemists this addition of the clarifying agent is always made?
A. Always.

Recross-examination by Mr. PLATT:

Q. Does any commercial granulated sugar test as high as 99.9?
A. I think that is possible, yes, sir.
Q. Allowing for the .3 variation couldn't that be read 100.2?
A. Undoubtedly; but in allowing for .3 variation you are not assuming that there would be always .3 variation in the readings. We are making a liberal allowance in such a case in order to be on the safe side. I consider it successive, and if I were forming regulations for testing sugar I should not be disposed to grant that range.

JOHN A. SHERER, called at a witness on behalf of the importers, being duly sworn, testified as follows:

By Mr. CLOSSON:

Q. You have been present here and heard the testimony of Mr. Bennett, Mr. Hasenclever, Mr. Landsmann, your brother, Mr. Sherer, and Mr. Grund, have you not?
A. Yes, sir.
491 Q. You furnished them, did you not, with the sugar which they tested according to their testimony?
A. Yes, sir.
Q. What was that sugar?
A. It was a high grade refined sugar made by the American Sugar Refining Company.
Q. Was the same sugar sent to each of these gentlemen?
A. It was.
Q. Have you prepared a statement showing the published tests by the Government laboratory of the refined sugar imported into the port of New York within the past few years?
A. I have.
Q. What period does it cover?
A. It covers from the period of July, 1899, up to the present time.
Q. And it includes the published Government tests of all refined sugars imported during that period?
A. Yes, sir.

By Mr. PLATT:

Q. Where was this published?
A. At the appraisers' office.

By Mr. CLOSSON:

Q. They are regularly posted?
A. They are regularly posted, for the information of the trade.
Q. And as posted they include the tests not only of the refined sugar, but also of the raw?
A. I have simply taken the refined.
Q. Exclusively of the one?

A. I have the raw from time to time as they are published, as fast as they come in.

Q. This statement consists of a number of columns; the first column headed "Importer" means what?

A. The name of the importer of the sugar.

Q. And the second headed "Vessel" means what?

A. The name of the vessel by which imported.

Q. The third column "Where from"?

A. The country from which it came.

Q. And column headed "Date of entry"?

A. Those are the months and date of entry.

Q. Another column headed "Character of product" has entries of "Ref.;" what does that mean?

A. The designation of the particular sugar.

Q. What does "Crystals" mean?

A. It means Russian crystals.

Q. What does "Gran." mean?

A. Granulated sugar.

Q. What does "Ref." mean?

A. Refined.

492 Q. What does "Loaf" mean?

A. It means loaf sugar.

Q. The next to the last column is headed "Appraised value"?

A. I don't know how it is so filled; it is merely the printed form. "Appraised value" means the test, polariscopic test.

Q. The Government test of the sugar?

A. The Government test of the sugar, on which it was appraised.

Q. And the last column headed "Remarks"?

A. The dates are put in there.

Q. Those are the dates of what?

A. The dates in which the sheets were published; the dates of the publication of the sheets.

Mr. CLOSSON: I offer in evidence this statement produced by the witness.

Objected to.

By Mr. PLATT:

Q. Are these reports printed?

A. No sir; the forms are printed.

Q. In the same form that you have here?

A. The same form.

Q. Same headings?

A. Same headings.

Q. And from what period do these sheets that are offered cover?

A. The first entry is July 13, 1899; up to February 19, 1901.

Q. Did you personally copy this from the appraisers' office?

A. I did not.

Q. Who did?

A. My clerk.

Mr. PLATT: I object to this paper now offered in evidence, because it is irrelevant to any issue in this case.

Q. Where is your clerk? Is he here?
A. No, sir.
Q. Is he in the city?
A. Yes. I can get him here.
Q. What did he copy? Is this the copy that he took directly from the appraisers, do you know?
A. These are copied from his original notes.
Q. Where are his notes?
A. In my office; but they include all the raw sugars as well; I didn't want to include those.
Q. This is confined to the refined?
A. This is confined to the refined, selected from these memoranda, in sheets by themselves in order to separate them. I would say it is a part of his duty to make these.
Q. Have you compared these statements here with the notes that he took?
493 A. Yes, sir.
Q. Are these certified at all by any appraiser or by any Government official?
A. No, sir.

Mr. PLATT: I object to this statement as irrelevant and incompetent.
Objection overruled; exception.
Said statement received in evidence and marked "Ex. 6. for Importers."

By Mr. SLOSSON:

Q. In what way are sugars imported into the United States at this port, bought and sold here?
A. They are bought and sold usually by contract.
Q. Is there a standard form of contract?
A. Yes; there are two or three forms; there is a form for foreign sugars and a form for what we call spot purchase domestic sugars.
Q. Upon what basis as to polariscopic test are sugars imported into this port bought and sold?

Mr. PLATT: I object to that as irrelevant; it is totally irrelevant how they are bought and sold.
Objection overruled; exception.

A. Centrifugal sugars are sold on the basis of 96, sometimes on a different basis, 95, usually 96 is the basis. Muscavado and molasses sugars are sold on a basis of 89. The terms are usually on centrifugal sugars one-thirty-second advance for every degree above 96 which they are found to test by the trade chemist, and a deduction of one-sixteenth of one per cent. per pound which they are found to fall off from 96 test. That is the basis on centrifugal sugars. The same rule applies to muscavado and molasses sugars on the basis of 89. This rule is varied in exceptional cases; but as a general thing what I have stated the sugars are sold on that basis.
Q. In what way according to the custom of the trade here is the test of the sugar ascertained?

Same objection, same ruling, and exception.

A. After the sampling is done in the manner described by Prof. Sharples yesterday, in this port in the same manner, the sample, after mixing a sample, is taken one by the buyer and one by the seller. From that is sent a small sample to two chemists. They are tested and these chemists send in their certificates. If they agree within .5 of a degree the average is taken and the sugar is sold on the price represented by that average test; if they don't agree by more than .5 a third sample is sent to a reference chemist a third chemist, one of the trade chemists. Then the two results nearest agreeing are averaged and the price based upon that
494 result.

Q. And upon the average of these two tests the sugar is bought and sold?

A. Yes, sir.

Q. Has the subject of any difference in the tests obtained by the trade chemists and those reported at the Government laboratory to your knowledge been recently the subject of any investigation by the Treasury Department?

A. Yes; the matter was investigated by Special Agent Ayer last summer and fall.

Q. Do you know Mr. Ayer?

A. I know him, yes.

Q. Did he make a report to the Government upon this difference and the causes of it?

A. He did.

Q. Has his report been published?

A. Not to my knowledge.

Mr. CLOSSON: Counsel for the importers calls upon the counsel for the Government to produce a copy of Col. Ayer's report.

Mr. PLATT: Counsel declines on the ground that it is irrelevant and incompetent; and has not got it within his control and never saw it.

Cross-examination by Mr. PLATT:

Q. This matter that you have alluded to here as to the system of buying and selling sugars here on condition is a matter of contract, isn't it, between buyer and seller?

A. Yes, a matter of contract between buyer and seller.

Q. As a rule, on these tests, which is the higher, the buyer's or the seller's chemist?

A. They vary; sometimes one and sometimes the other.

FERDINAND G. WEICHMANN, called as a witness on behalf of the importers, being duly sworn, testified as follows:

By Mr. CLOSSON:

Q. You testified before the board of appraisers in this case, did you not?

A. Yes.

Q. As to your education and qualifications and business?

A. I did, sir.

Q. What is the formula that has been referred to in the testimony as Jobin's formula?

A. The formula referred to as Jobin's formula is printed in my paper, which the Government has yesterday submitted in evidence (Ex. 1). The formula reads: "Polarization: + [0.00016T] N." In this formula the "T" stands for the difference in temperature at which the sugar solution is prepared and polarized and the temperature at which the saccharimeter has been graduated. "N" stands for the number of degrees read off on the polariscope when the observation is being made.

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Q. What is the purpose and use of this formula?

A. The object of this formula is to correct for the change in optical value which the quartz wedges and polariscope experience on being brought to a temperature different from that temperature at which the instrument was graded.

Q. What is the physical effect of the increased temperature upon the quartz wedges?

A. An expansion.

Q. What is the effect of an expansion of the quartz wedge upon its polarizing power?

A. The result of this influence of temperature on the quartz wedges is to bring about an apparent decrease in the reading of the sugar value of the solution which lies in the tube of the polariscope.

Q. Is there among scientists any difference of opinion upon the point that temperature does exercise an effect upon the polarizing power of quartz plates?

A. To my best knowledge and belief there is not.

Q. It is unanimously recognized that that is true?

A. As far as I know it is true.

Q. And is Jobin's formula recognized among scientists as the proper correction for that error?

A. As far as I know it is.

Q. Have you ever known it questioned?

A. I have not.

Q. What is the history of Jobin's formula?

A. This formula called Jobin's formula is essentially the same as the formula by Joubert.

Q. Have you not been informed that the difference between Jobin's and Joubert's formula is simply that Jobin's formula takes into consideration also the expansion upon the brass scale?

A. I have been so informed.

Q. And either Jobin's formula or Joubert's formula, this correction has been recognized among chemists I understand for some fifty years?

A. I do not know.

Q. For a long period of time?

A. Jobin's formula as such stands only for the past ten years.

Q. And previous to that Joubert's formula has been recognized as the proper correction?

A. I can't testify to that of my personal knowledge.

Q. Have you applied the Jobin's correction to the readings of the different chemists who have testified here, to the results of polarizations obtained by them, upon the same sample of sugar at different temperatures?

A. I have, sir.

496 Q. Take first, if you please, the readings testified to by Dr. Austin and Dr. Wiley and Dr. Chapman; they testify to certain readings made by them jointly. Have you applied the Jobin's formula to those readings?

A. I have.

Q. Will you state what those readings are as corrected by the Jobin's formula?

A. The figures I do not remember.

Q. Can you, by refreshing your recollection, give me the exact figures? Give first the figures without the Jobin correction and then the figures with the Jobin correction.

A. The testimony to which I refer was that given by Dr. Austin. Dr. Austin stated that he examined the sugar, which he made up and polarized solutions respectively at 6° C., 25.5° C. and 36.5° C. The readings which he obtained at those temperatures were (reference to the original testimony is page 49), at 6° C. 100.58, at 25.5° C. 99.80, at 36.5° C. 99.65. Dr. Austin then went on to say that he had made no correction of any kind, either by Jobin's formula or in any other manner, on these readings, but he reported them exactly as found. These figures corrected by Jobin's formula give for the value he obtained, at 25.5° C. 99.93, for the temperature at 36.5° C. 99.95.

Q. Does that cover that?

A. The observation at 6° C. I have disregarded, because that is a temperature that does not obtain in technical sugar analysis.

Q. Take the figures testified to by Prof. Huntington and apply the same corrections there, the original figures and the figures as corrected by Jobin's formula?

A. Prof. Huntington reported two figures; one he obtained at 10° C.; this was 100.12. The second figure he obtained at 23° C. and it was 99.72. It is necessary to state that in presenting these figures Mr. Huntington stated he had applied to them a subtraction of 0.08 from the average of the actual polarization readings he had obtained.

Q. What reason did he give for that subtraction?

A. The reason he gave for making the subtraction was that the flask which he used was "too large for a true Mohr flask," page 146 of the testimony.

Q. What was the effect there upon the polarizing of the solution?

A. If a flask in which you make a solution is too large it means that you have a given weight of sugar dissolved in a greater amount of water than it should be dissolved in. In consequence the solution is more dilute than it should be, and as a result the polarization would naturally be lower than it normally should be.

Q. Then the correction, instead of being a subtraction, it should have been——?

A. It should have been added.

Q. Have you made that correction?

497 A. I have not; I have taken his figures exactly as he gave them, and applying to them the Jobin correction the figures become at 10° C. 100.00, and at 23 C. 99.81. These values differ by .19 V. The Government in its regulations, act of July 24, 1897, page 23, allows .2 of a degree as the limit of variation.

Q. Have you applied the Jobin's correction in the same way to the figures reported by the trade chemists who have testified here, Mr. Bennett, Mr. Hasenclever, Mr. Landsmann, Mr. Sherer and Mr. Grund?

A. I have sir.

Q. Give their figures uncorrected and their figures as corrected by the Jobin's formula?

A. Mr. Bennett's figure at 17° C. was 99.71; applying this Jobin correction this value becomes 99.71; at 25° C. Mr. Bennett's figure was 99.65; applying Jobin's correction it becomes 99.77; at 30° C. Mr. Bennett's figure was 99.53; applying Jobin's correction it becomes 99.73. These values as will be seen are virtually identical.

Mr. Hasenclever's figure at 17.5° C. was 99.75; applying Jobin's correction 99.75; at 23° C. Mr. Hasenclever's figure was 99.65; with Jobin's correction 99.74; at 25.5° C. Mr. Hasenclever's figure was 99.55; with Jobin's correction 99.68. Again a maximum variation of less than 0.1.

Mr. Landsmann's figures at 17.5° C., 99.76; applying Jobin's correction 99.76; at 25° C. observed value 99.68; after introduction of Jobin's correction 99.80; at 30 C. 99.63 observed; after introduction of Jobin's correction 99.83.

Mr. Edward Sherer's figures at 17.5° C. observed 99.80; after introduction of Jobin's correction 99.76; at 25° C. observed 99.75; after Jobin's correction 99.83; at 30° C. observed 99.70; after Jobin's correction 99.86.

Mr. Grund's figures at 17.5° C. observed 99.93; after introduction of Jobin's correction 99.93; at 25° C. observed 99.86; after Jobin's correction, 99.98; at 30° C. observed 99.85; after Jobin's correction 100.05.

Q. The Government produced yesterday and put in evidence a copy of pamphlet read by you at the recent meeting of the International Sugar Commission in Paris?

A. Yes.

Q. That pamphlet (Exhibit I) embodies the results of a number of observations and experiments that you have made upon the question at issue here?

A. It does.

Q. So far as the statements in that pamphlet are statements of fact, are they correct?

A. To the best of my knowledge and belief.

Q. So far as they are expressions of opinion, what do you say as to them?

A. I return the same answer.

498 Q. And the statements of opinion are the results of your professional observation?

A. Yes, and my best professional thought and research.

Q. Dr. Wiley, I think, was unable to produce a copy of the paper read by him at that meeting?

A. I understand that he so stated.

Q. Has an abstract of that paper been published in the trade journal known as the *"Sugar Beet"?*

A. What purports to be an extract of that paper has appeared in the *Sugar Beet,* published in Philadelphia, August, 1900. The whole paper has appeared in German—Prof. Wiley's original paper has appeared in German.

Q. You read German, do you not?

A. Yes, sir.

Q. Have you read the paper in German?

A. Yes.

Q. Is the abstract of it published in the *Sugar Beet* correct?

A. As far as it goes it is practically correct; I have compared the two.

Q. And the paper that I now show you is the abstract printed in the *Sugar Beet?*

A. Yes; that is practically a copy of the same paper.

Mr. CLOSSON: I offer this paper in evidence.

Same received in evidence and marked "Exhibit 7 for importers."

Q. You were present and heard Dr. Wiley's testimony as to the proceedings at the meeting of this commission in Paris?

A. I did.

Q. And so far as his account of it went it was in the main correct, was it not, according to your recollection?

A. There were one or two slight corrections that I should make if I were called upon to testify as to that meeting.

Q. But in the main it was correct, with some additions which you would make?

A. Yes, sir.

Q. Will you state the history of the proceedings at that meeting, omitting any part of these proceedings as to which you have no corrections to make in Dr. Wiley's statement?

A. Prof. Wiley has stated that he read his paper and that I read mine; that a discussion followed the reading of these two papers, which was participated in by several gentlemen whom I believe Dr. Wiley has mentioned, among others, Prof. Brodhun. When the resolutions came up, which should be adopted by the international commission for uniform methods of sugar analysis, the question arose at what temperature all polarizations should be conducted. All European members agreed that 20° C. should be the normal temperature for their respective countries.

Q. That is equivalent to 68° F.?

499 A. I think it is. Prof. Wiley, Dr. Winter of Java, and myself at once objected that we could not conform to that condition, in other words, that in our respective countries we could not all the year around work at the standard temperature of 20° C. Thereupon Prof. Herzfeld arose, as president of the commission, and

asked what suggestions we gentlemen might have to make with respect to that matter. Prof. Wiley thereupon offered the method which he had just discussed before the commission as the method to be adopted in such countries where 20° C. could not be admitted as the normal temperature. Upon Prof. Herzfeld's putting the question as to whether we would agree to this, I protested and declared that if Prof. Wiley's method were adopted the results obtained would be utterly wrong. As both Prof. Wiley and myself had referred to Prof. Herzfeld incidentally as sustaining our respective positions, Prof. Herzfeld, who is on record in print as having secured results entirely opposite to those found by Prof. Wiley, arose and said that he agreed with both of us. To this Prof. Wiley very properly objected and stated that either he himself or Dr. Wiechmann must be wrong. The matter hereupon was dropped, adjournment for lunch was taken, and after lunch Prof. Sachs offered a resolution to cover the temperature question as involved in this matter, which was unanimously agreed to and accepted.

Q. Were not some amendments offered to that resolution?

A. Prof. Wiley suggested an amendment to Dr. Sachs, but he did not accept it nor did he incorporate it in the motion as adopted.

Q. Was that amendment proposed in writing?

A. It was.

Q. You were the English secretary of the commission?

A. I was. I have both the original motion of Prof. Sachs and Prof. Wiley's proposed amendment.

Q. Have you them both here?

A. Yes, sir.

Q. Will you produce the original resolution offered by Prof. Sachs?

A. I will (witness produces a paper).

Q. In whose handwriting is this paper?

A. Prof. Sachs.

Q. Have you a copy of it?

A. You have a copy of it as printed; that was the copy that was offered in evidence and included in Exhibit H.

Q. It appears in the printed report of the proceedings; the resolution is there correctly transcribed?

A. It is.

Mr. CLOSSON: Is it admitted that the paper produced is a correct copy of the resolution as printed in this journal an page 6, Exhibit H for Government?

I offer this copy of the resolution in evidence.

Same received and marked Exhibit 8.

500 The WITNESS: I desire to retain this original copy of Prof. Sachs' resolution.

Q. And as secretary of the meeting the written amendment proposed by Dr. Wiley came into your possession?

A. It is one of the papers that I have had in my possession.

Q. And that is the paper that you now produce?

A. It is (producing a paper).

Q. That is in Dr. Wiley's handwriting and signed by him?

A. Yes, sir.

Q. And in French?

A. Yes sir; which Dr. Wiley offered to Dr. Sachs' resolution and which Dr. Sachs declined.

Q. Are you conversant with French so as to be able to translate it?

A. I am.

Mr. CLOSSON: I offer this paper in evidence; and believe the Government will substitute for it Dr. Wiley's translation in English.

Same received in evidence and marked "Ex. 9 for importers."

Dr. WILEY (translating said Ex. 9): As a general rule the analysis of sugar should be made at 20° C. and the adjustment or verification of the polariscope should also be made at 20° C. (But in the countries where the deviation of the temperature from 20° C. is often very great it is necessary to graduate the polariscopes for the ordinary temperatures or to make a proper correction to the readings of the polariscope.)

The part that I suggested is in the parenthesis; the rest is exactly the same as the other.

Mr. CLOSSON: Below the phrase read by Dr. Wiley is the following: "I propose to introduce the phrase between parentheses, Wiley."

By Mr. CLOSSON:

(Continuing examination of witness WIECHMANN:)

Q. What was the action of the commission on this amendment?

A. This amendment was not accepted by Dr. Sachs.

Q. Was it accepted by the commission?

A. It was not brought before the commission as such.

Q. Is there anything else to add to your history of the proceedings of the meeting, or does that complete it?

A. I think that is the only point in which we differed at all.

Q. Dr. Wiley spoke in his testimony of a recent paper by Dr. Schonrock; was that paper published in the April number of some trade journal, German trade journal?

A. It appeared originally in the *Zeitschrift fur Instrumentenkunde*, 1897; it is republished in the April, 1900, number of the *Zeitschrift des Vereins der Deutschen Zucker-industrie*.

501 Q. That is the paper referred to on the page you have inserted in your pamphlet (Ex. I)?

A. Yes, sir.

Q. You stated, Dr. Wiechmann, what manipulations sugar samples taken from vessels entering this port undergo before they reach the test tube of the polariscope, so far as any of these manipulations tend in your opinion, to raise the test?

Objected to as immaterial.

Objection overruled; exception.

A. I should say that there was danger of raising the test of the

sugar, first, by the manipulation of mixing; second, by the introduction of clarifying agents into the polariscope flask in which the solution is prepared; and, thirdly, there is an element of danger in the evaporation of the solutions during filtering, although this last named cause can certainly be avoided by proper and careful manipulation.

Q. Did you make certain tests of sugars in 1890 under instructions received by you from Dr. Wiley?

A. I did.

Q. Will you state briefly what those instructions were and what the experiments were?

A. I have not consulted the record of my work in that respect for a number of years, but as I remember it Prof. Wiley as an officer of the Government was entrusted with the securing of and the analysis of a certain number of sugar samples, a certain number of molasses samples, a certain number of honeys, and a certain number of confections, candies. I received at that time a sample of sugar from Prof. Wiley with a request to test it and to determine its reading value on my polariscope. This I did and reported to Prof. Wiley when my investigation was concluded.

Q. Did Prof. Wiley at that time give you any instruction in regard to the temperature at which these samples were tested?

A. I do not remember that any such instructions were given.

Mr. PLATT: I move to strike that out as irrelevant, that last question and answer.

Motion denied; exception.

Mr. PLATT: This paper, Exhibit 7, "The Sugar Beet," which was offered in evidence, purports to be a history of what took place in the "third meeting of the International Commission for Uniform Methods of Sugar Analysis," and it doesn't end where it is cut off; it ought all to go in. I ask to have this full sheet containing that article substituted for the paper marked Exhibit 7.

Said paper offered by counsel for United States received and marked Exhibit 7-*a*.

502 Cross-examination by Mr. PLATT:

Q. Is this (Ex. 7-*a*) a correct account of the proceedings so far as it goes?

A. I do not know; I say it purports to give an account of Dr. Wiley's paper.

Q. It is said here in this paper (Ex. 7-*a*) that "the commission, with one exception, are of the opinion that the specific rotatory power of sugar is profoundly affected by temperature falling as the temperature rises and *vice versa*." Was that the fact?

A. No, sir; that is not a fact.

Q. With one exception?

A. No, sir; that is not a fact.

Q. How many exceptions were there?

A. I will be able to give Prof. Herzfeld's statement which I have with me in letter form.

Q. How many exceptions were there? Were there any except yourself?

A. Dr. Wiley and myself were the principal parties who discussed this matter, and Dr. Brodhun offered some criticism on some remarks in regard to my paper. Prof. Herzfeld took part in the discussion.

Q. Wasn't it the unanimous opinion that temperature did affect the specific rotatory power of sugar?

A. No, sir; most decidedly not; the commission as such rendered no verdict as such on the subject.

Q. You have stated on the stand that there is no difference of opinion among scientific men upon that point?

A. No, sir; I have not.

Q. Or words to that effect?

A. No, sir; I have not.

Q. Then, this paper that you have offered in evidence from "Sugar Beet" contains a statement that is not correct in your opinion?

Mr. CLOSSON: I object: Dr. Weichmann didn't offer this in evidence. I object to the question on the ground that it assumes that Dr. Wiechmann offered the paper in evidence. The only paper offered in evidence was so much of the paper as purported to be from Dr. Wiley's paper.

Q. Did you produce this paper (Ex. 7-*a*) "The Sugar Beet"?

A. I did not.

Q. Do you know where it came from?

A. I don't know whether Mr. Closson got it directly or indirectly. The one that was offered here was the so-called mutilated copy.

Q. Did you produce that?

A. I did.

Q. Did you mutilate it?

A. I did, if you call it mutilating.

503 Q. Do you recollect whether Prof. Brodhun stated that Prof. Schonrock's work was correct?

A. Prof. Brodhun stated in his opinion that my criticisms of Prof. Schonrock's work were not justified.

Q. Didn't Prof. Herzfeld agree with Dr. Wiley that the temperature did affect the specific rotatory power of sugar?

A. No, he did not. "I agree with both Dr. Wiley and Dr. Wiechmann;" that is as far as he got. Here is that report in print as agreeing not with Dr. Wiley but myself.

Q. Where is that report in print?

A. It is in the *Zeitschrift des Vereins der Zucker-Industrie;* I think it is there.

Q. How many years ago was it published?

A. It was published in either 1899 or 1900.

By Mr. CLOSSON:

Q. Have you that paper here?

A. No, sir; but it is referred to in some of my papers here. The

reference which I made (in Ex. I, p. 18) is contained in Prof. Herzfeld's article published in the *Zeitschrift des Vereins der Deutschen Zucker-Industrie*, in 1899, I think, either it is 1899 or 1900.

By Mr. PLATT:

Q. You and Dr. Sachs, are you intimate friends?

A. Not at all. I had the pleasure of meeting him there for the first time.

Q. Did Dr. Sachs tell you the reason why he didn't accept the amendment of Dr. Wiley?

A. Not at that moment; but I know his reason, if you want to know it.

Q. Did he ever tell you his reason?

A. He made the statement in a public meeting in Paris.

Q. Never told you anything privately about it?

A. Nothing beyond this.

Q. Doctor, when do you consider a polariscope as being in adjustment?

A. It is exceedingly hard to answer your question, but I will gladly do it. What is it that you want to know?

Q. When do you consider a polariscope to be in adjustment?

A. I consider a polariscope to be in adjustment when there is perfect equality of the two halves of the field, when there is no optically active substance in the field of view outside of component parts of the instrument, and when under these conditions the scale indicates zero. Furthermore, when a solution of chemically pure sugar prepared at the temperature at which the polariscope was graduated and read at that temperature indicates exactly 100 degrees on the scale.

504 Q. What is your usual method of ascertaining the correct adjustment?

A. The usual method of ascertaining the correct adjustment is by means of quartz plates, the value of which has been ascertained by having them tested against chemically pure sugar solutions.

Q. If your quartz plate shows the polariscope out of adjustment do you correct before reporting the reading?

A. I do one of two things. If the quartz plate shows the polariscope to be seriously out of adjustment I adjust the polariscope by means of a key; if it is slightly out of adjustment I prefer not to disturb the wedges, but to make the correction by calculation before reporting any results.

Q. You maintain that a pure sugar does not change its rotatory power by changing the temperatures?

A. I maintain that a chemically pure sugar does not change its specific rotatory power with a change of temperature.

Q. Pure sugar which reads 100 on a correct polariscope at the temperature at which it is graduated you think will vary in that reading by 0.16 if polarized at a temperature 10° removed from the standard?

A. I do.

Q. This variation is not due to a change in the sugar, is it?

A. In my opinion it is not.

Q. Then it must be due to a disturbance of the adjustment of the polariscope, isn't it?

A. Not at all; the polariscope remains in perfect adjustment. It is due to an expansion of the quartz plates.

Q. Does the sugar read 100?

A. The only means we have of ascertaining the reading of the sugar solutions is through the language of the polariscope. The reading that you get in the language of the polariscope is not 100, but about as we have stated, 0.16 of a degree lower than 100 for a difference of 10° C., if the temperature is above the standard.

Q. If it is below the standard?

A. The variation would be the other way.

Q. And the sugar would read how much?

A. I should say, if it was chemically pure sugar 100.16.

Q. A properly adjusted polariscope will read pure sugar at 100?

A. At the standard temperature; but now we are not at the standard temperature any more. You understand that in the case you have cited the saccharimeter itself was in the one case 10° higher than the standard temperature at which it was graduated, and in the other case 10° lower than the standard temperature at which it was graduated.

Q. Then, would you correct your reading before reporting it?

A. In the case of a scientific investigation every time.

Q. If the quartz wedge showed a variation of 0.16 would you correct?

505 A. I must ask a qualification of that question. I can't understand it as it stands.

Q. (Question repeated.)

A. If it showed a variation in the adjustment of the instrument I should certainly correct, but if it showed a variation solely due to the temperature influence on the quartz wedges I should make my correction by calculation only by Jobin's formula, because as soon as the instrument comes back to the normal the instrument will return an absolutely correct reading.

Q. If you have a pure sugar that read 99.90 at a temperature of 27.5° would you correct it before reporting it?

A. I would.

Q. If you have a sugar, commercial sugar, that polarized 99.90 at 27.5°, would you correct that?

A. I would not.

Q. Why not?

A. Because, in the preparation of the solution of this last named sugar, we are obliged to introduce clarifying agents into the solution. These clarifying agents produce a precipitate in the solution and therefore occupy part of the space that should be occupied by the solution. The unavoidable sequence of this is that the solution is more concentrated than it should be and the reading that such solution returns is higher than it should be. I therefore hold that this unavoidable error caused by the precipitate in one direction

far more than offsets the decrease caused by the influence of temperature upon the quartz wedges of the instrument, would justify me and does justify me in not making any correction.

Q. Would there be much lead concentrated in the sugar at 97.90?

A. That would depend on the quality of the sugar.

Q. Suppose you polarized a sugar at 97.90 at the temperature at which the instrument was standardized?

A. I would simply return the polarization as I obtained it.

Q. Has not that the same amount of clarifying agent in it?

A. It probably has.

Q. Isn't that reading too high then?

A. In that respect it is, but it is far more than outweighed in the work done by other samples which are perhaps polarized at higher temperatures.

Q. You are in the employ of one of the parties to this action, are you not?

A. I am the consulting chemist of the American Sugar Refining Company.

Q. How many years have you been employed by them?

A. About fourteen years by the American Sugar Refining Company and their predecessors.

506 HARVEY W. WILEY, recalled as a witness for the United States, testified as follows:

By Mr. PLATT:

Q. In regard to this amendment that has been put in evidence of yours, Dr. Wiley, it has been stated that it was not accepted by Dr. Sachs. Did Dr. Sachs and you have any conversation upon that subject?

A. I will state, Mr. Referee, as I did yesterday, that I don't remember the circumstances of these amendments——

Mr. CLOSSON: I object upon the ground that evidence by Dr. Wiley of a private conversation between himself and Dr. Sachs is hearsay testimony and not admissible.

Objection sustained.

Answer insisted upon and admitted under rule XI.

A. I would like to state in regard to the time in which this amendment was offered. I don't doubt that Dr. Wiechmann is correct, as he has the papers. I was under the impression that that which I offered was the one in which I stated we agreed upon .3 of one degree for the different temperatures, but it is possible that this may not be the one, and on that assumption I will say that I offered that for the sake of simplifying the adjustment of the polariscope, so that one polariscope could be adjusted or standardized for different temperatures, and I offered that to Prof. Sachs in this understanding, and it was at this meeting and not at the time that my paper was furnished. After I had offered that to Prof. Sachs he came around to me and said that he didn't want to accept that because it would not be agreeable to Dr. Wiechmann to have it in

that form, and I said that "as your resolution embodies exactly the principle that I contend for I will withdraw it;" and that was the reason that he told me that he didn't accept it.

Adjourned.

507 United States Circuit Court, Southern District of New York.

No. 2918.

BARTRAM BROS.
vs.
THE UNITED STATES.

No. 2919.

BENJAMIN H. HOWELL, SON & CO.
vs.
SAME.

No. 2920.

THE AMERICAN SUGAR REFINING CO.
vs.
SAME.

Hearing resumed May 16, 1901.

Before Hon. William B. Howell, as officer of the court.

Appearances.

For the importers, H. B. Closson.
For the United States, Henry C. Platt, assistant U. S. attorney.

BYRON D. C. FOSKETT, called as a witness on behalf of the importers, being duly sworn, testified as follows:

By Mr. CLOSSON:

Q. You are employed by the Government in the United States appraiser's stores in this city?
A. Yes, sir.
Q. In what capacity?
A. As examiner in charge of the sugar records and classification.
Q. Did you hold that office in the months of January, February, March and April in the year 1898?
A. No, sir.
Q. What was your office then?
A. An examiner of sugar, not in charge of the records.
Q. Have you in obedience to a *subpœna duces tecum* served upon

you produced the records in which are recorded the polariscopic tests of sugar taken in those months?

A. Yes, sir.

Q. Will you please produce them? (Witness produces certain books and documents.)

Q. Will you turn to the records for January 9th or 10th, 1898, and state what your record shows as to the tests of samples of sugar imported on the sailing vessel "Cameo" by Messrs. Bartram Bros.?

A. Yes, I have it here.

508 Q. Will you read the record?

A. (Reading:) On January 8th, I find that samples representing sugar marked "B. S., 196 bags molasses sugars," two samples were sent to the laboratory for test.

Q. On January 8th?

A. On January 8th.

Q. Is there a similar entry about January 12 or 13?

A. There are several marks of the same vessel.

Q. Will you read them?

A. Another marked "$\frac{F}{B}\ \frac{R}{S}$ 187 bags centrifugal sugar," two samples sent to the laboratory; another marked "$\frac{R}{A}\ \frac{F}{}$ 50 bbls. muscovada sugar," two samples; "L L 450 bags molasses sugar," two samples; "$\frac{\sim}{B}\ \frac{f}{H}$ 17 hogsheads muscovada sugar," two samples; that is all on that date.

Q. These are the samples which were sent on the 8th of January, 1898, to the laboratory for test?

A. Yes.

Q. Of sugar from the "Cameo" of Bartram Bros.?

A. Yes.

Q. Have you some similar entries on or about January 12 or 13?

A. On January 12th four samples were sent to the laboratory from the "Cameo."

Q. Turning now to the records of January 25 or 26, do you find records of samples of sugar imported by the steamer "Santiago" by B. H. Howell, Son & Co., sent to the laboratory?

A. On January 26, by B. H. Howell, Son & Co., by the "Santiago," four samples were sent to the laboratory for test.

Q. Follow down those tests until the 31st and mention the number of samples sent of sugar from the "Santiago"?

A. On the 26th I find further eight tests; on January 27th eight tests; on January 28th two tests were made; completing the cargo.

Q. That completes the cargo, you say?

A. Yes.

Q. Then, as to samples of sugar from the "Aloedene," imported by the American Sugar Refining Company, what records have you between February 2d and 7th?

A. I find on February 3d twelve samples were sent to the laboratory; on February 4th sixteen samples were sent; on February 5th sixteen samples; on February 7th twelve samples.

Q. Completing the cargo?

A. Completing the cargo.

Q. Turning now to the records between April 20th and 30th of samples from the "Gladiolus," imported by the American Sugar Refining Company?

A. April 22d four samples were sent to the laboratory; on
509 April 26 fourteen samples were sent to the laboratory; and on April 28th ten samples, completing the cargo.

Q. Were there no samples from the "Gladiolus" sent before April 22d?

A. There doesn't appear to be any record here (referring to book held by witness).

Q. You find nothing earlier than April 22d?

A. No, sir.

No cross-examination.

RUSSELL W. MOORE, called as a witness on behalf of the importers, being duly sworn, testified as follows:

By Mr. CLOSSON:

Q. You are employed by the Government at the United States appraisers' stores, Dr. Moore?

A. I am chemist in charge of the laboratory.

Q. Did you hold that office between January and April, 1898?

A. No, sir; I didn't hold the office as chemist in charge until the end of March, 1898.

Q. Before that time?

A. I was examiner in the seventh division.

Q. Have you examined the records kept by your office there so as to be able to state upon what dates the polariscopic tests were made of the samples of sugar sent you from the "Cameo," "Santiago," "Aloedene" and "Gladiolus"?

A. I have examined those records.

Q. Will you state, if you please, the different dates upon which those tests were made?

A. I gave those dates to Mr. Sherer in the office and I haven't them with me; Mr. Sherer took them down under my eye.

Q. You can refresh your memory by looking at Mr. Sherer's memorandum (handing witness a paper)?

A. I may say that Mr. Sherer gave me the dates and names of the vessels, and I went to Mr. Foskett and obtained the serial numbers covering these importations, and when Mr. Sherer was calling I gave him the dates on which those numbers were tested.

Q. And those dates are as follows.

A. They covered that period and I believed them to be correct.

Q. Now, will you state the dates on which the tests were made?

A. (Referring to memorandum). From the "Cameo" January 10th and 14th; from the "Santiago" January 27th, 28th, 29th and 31st; by the "Aloedene" February 4th, 5th and 7th; and "Gladiolus" April 27th, 28th, 29th and 30th.

Q. Do you know, Dr. Moore, whether any records of the temperature at which these tests were taken were kept?

510 A. There was no record of the temperature at which the tests were taken in the sugar room; the record on that point was not begun to be kept until the 16th of June of the same year.

No cross-examination.

SAMUEL F. BALL, called as a witness on behalf of the importers, being duly sworn, testified as follows:

By Mr. CLOSSON:

Q. Were you in the employ of the Government at the United States appraisers' stores between January and April, 1898?

A. I was.

Q. What was your office?

A. Examiner and chemist.

Q. What were the experiments or tests which it was your business to conduct at that time?

A. The work was more or less varied, but it was essentially in the line of distillate work.

Q. In conducting those tests did you keep at that time a record of the average temperature of your room on different dates in those months?

A. On such dates as I performed alcoholic distillations the record of the temperatures was kept.

Q. Can you, by turning to your records, ascertain what was the average temperature of your laboratory on the following dates: January 10th?

A. Yes; you wish the temperature?

Q. Yes.

A. The average temperature was 22.5 degrees.

Q. January 14th?

A. 24 degrees. Those are centigrade degrees.

Q. January 27th?

A. 23 degrees.

Q. January 28th?

A. 24 degrees.

Q. January 29th?

A. 20 degrees.

Q. January 31st?

A. 18.5 degrees.

Q. February 4th?

A. 23.5 degrees.

Q. February 5th?

A. 20 degrees.

Q. February 7th?

A. 21 degrees.

Q. April 22d?

A. 21.5 degrees.

Q. April 30th?

511 A. 25 degrees.

Q. What was the situation of the room in which you conducted these tests as regards the room in the same building in which the polariscopic tests were conducted?

A. Our room was the room underneath the one in which the polariscopic tests were made.

Q. Were they heated in the same way?

A. Yes; they each had one steam radiator.

Q. Was the size about the same?

A. Yes, about 26 feet square.

Q. How did the conditions as to temperature in the two rooms approximate?

A. I never compared the temperature.

Q. You never made observations, but in a general way say?

A. I don't know as a matter of fact because I never compared the rooms.

Q. Which of the two rooms was the better supplied with heat?

Mr. PLATT: Objected to as irrelevant and incompetent to show the temperature of a particular room at the time of these tests.

Objection overruled; exception.

A. Well, apparently they were both supplied in the same manner; the rooms were the same size and had the same radiator.

Q. Taking two rooms of the same size, furnished with the same radiators, with steam heat from the same source, one room above the other, which in the ordinary course of things is the warmer, the lower room or the upper room? Where does the steam go, the lower room or the upper room?

Same objection, same ruling, and exception.

A. Well, naturally the heat would rise.

Cross-examination by Mr. PLATT:

Q. Did you take the temperature of the alcoholic distillates in conducting these tests?

A. The temperature of the samples remaining in the room in the morning when starting to work; it is necessary to take the temperature of the samples before starting the distillation in order to have the distillate at the same temperature as the sample before determining the specific gravity.

Q. Samples change their temperature very slowly?

A. Of course that depends upon the temperature of the room.

Q. Do samples change their temperature as quickly as the temperature of the room does?

A. It depends upon the size of the samples; a small sample would change very quickly if there is a decided change in the room; ordinarily during the course of the day the changes of the

512 figuring or the averages from the morning to the afternoon, I find that the maximum has not been more than five degrees during the entire day. Of course we cannot say there has been a

very great change either in the sample or the distillate; the distillate will change much more rapidly than the sample because it is a very small flask of liquor.

Q. You didn't take the temperature of the room at all?

A. Only the temperature of the samples.

Q. Then, the other room upstairs, you never took the record of the temperature of that room?

A. No.

Q. You hadn't anything to do with that at that time?

A. I had no connection with it at that time.

Q. The difference of the temperature between one room in a building and that of another room would depend upon a variety of circumstances or incidents, would it not?

A. That would be an assumption.

Q. All your testimony in that respect is an assumption, isn't it?

A. As comparing my room with another room?

Q. Isn't it an assumption?

A. Necessarily so.

By Mr. CLOSSON:

Q. It isn't an assumption that the other room had one radiator like yours?

A. No; and not the size of the room or the manner in which it is heated.

By Mr. PLATT:

Q. You haven't any knowledge of the temperature of this sugar room on those dates?

A. No direct knowledge; as a fact I have no knowledge.

EDWARD SHERER, recalled as a witness on behalf of the importers, testified as follows:

By Mr. CLOSSON:

Q. What was your position in the months of January, February, March and April, 1898?

A. I was chemist in charge of the United States laboratory and specifically in charge of the work of testing sugars.

Q. Have you heard the testimony as to the dates on which tests were made of certain sugars imported per "Cameo," "Santiago," "Aloedene" and "Gladiolus"?

A. I have heard the testimony.

Q. Who made those tests?

A. They were made under my supervision by the employees of the sugar room and by myself.

513 Q. Were you personally in the room in which those tests were made at that time?

A. I was.

Q. Did you at that time know the temperatures?

A. I made no record of the temperature; I noted the temperatures.

Q. Will you give your best recollection as to the temperatures prevailing on those different dates?

A. It would be impossible for me to recollect the temperatures on any one exact date; I can only state what the average temperature of the sugar room was during the time those tests were made.

Q. State that?

A. On very cold days it fell as low as 20 degrees, but it oftentimes goes as high as 24 and even higher. Our object of course was to get the temperature up when the weather was cold; as soon as possible every effort was made to do this, in lighting gas stoves and burners in the room.

Q. What temperature did you endeavor to keep the room at?

A. Somewhere in the neighborhood of 22 or 23 degrees; we didn't wish it less than that.

Q. And it fell occasionally two degrees below that and sometimes one or two degrees above that?

A. I should say the average was somewhere between 22 and 23.

Q. Was there any change in the average temperature in the month of April as compared with the temperatures in January and February?

A. It was higher during the early spring months, because we still had the steam heat and the weather was not really cold.

Q. State about what was the average temperature in the month of April or the latter part of the month of April.

A. The average was fully 24 I should say, occasionally higher.

Cross-examination by Mr. PLATT:

Q. How did you ascertain the average temperature?

A. I am giving you my recollection what the average temperature was; it was necessary for me to know the temperature at which the polarizations were made in order to apply the temperature corrections required by the regulations; I took careful note of the temperature whenever tests were made.

Q. Have you got any record of the temperatures?

A. But I kept no record of the temperature.

Q. What do you mean by making note of the temperature?

A. I mean that when the polarizations were made I looked at the thermometer and saw what the temperature was at which the work was done and then applied the necessary corrections before reporting the polarization of the sample.

Q. So you reported the corrected observations without keeping any record of the temperature?

A. Yes, sir.

514 Q. Then, your testimony in regard to the temperature is based on your recollection?

A. The testimony I am giving you now, yes, sir.

Q. There is nothing in writing to refresh your memory?

A. No, sir.

JOHN A. SHERER, recalled as a witness on behalf of the importers, testified as follows:

By Mr. CLOSSON:

Q. You have heard the testimony of the previous witnesses as to the temperatures supposed to have prevailed in the laboratory at the time the tests of the sugars in question were made?

A. Yes, sir.

Q. You had previously learned from them, had you, what their testimony in that regard would be?

A. Yes; I had learned the best evidence they could give me, the best information they could give me in regard to it.

Q. Have you at my request made a calculation showing what were, according to the Government regulations in force, the corrections made in the polariscopic readings at those different temperatures?

A. I have.

Q. And the difference in the rate and amount of duty consequent thereon?

A. Yes, sir.

Q. And the total difference in the duties payable on the different cargoes?

A. I have.

Q. Turning to the sugar ex "Cameo" what temperatures have you assumed in your calculations as prevailing at the laboratory?

A. I have assumed the temperature as given by Mr. Ball, the average of his temperatures, and also the average of the temperatures as given by Mr. Sherer, and made the calculations on both bases.

Q. State in detail what those calculations are as you have them, upon the assumption you have stated?

Mr. PLATT: I object to this because it is not based on reliable data; it is based on what he has learned from Mr. Ball who gave us the average temperature of another room. It appears that no record was kept of the temperature in this sugar room and there is nothing on which to base any accurate calculation.

Objection overruled; exception.

A. My calculations appear upon this paper which I produce (witness produces a paper), which shows that by the Government's official test the duties would have been $5,354, and with the deduction which we make of the temperature which I have would be
515 $5,332.80 showing a difference of $21.20 increase of duties; by the other temperature, 23 degrees, it would be $23.08 on the same cargo (referring to the importation per "Cameo").

Q. Do you produce similar statements as to each of these cargoes?

A. Yes, sir (witness produces statements).

Q. This statement of the sugar by the "Santiago" was made up on the same basis?

A. Yes, sir. The "Aloedene" is also made up on the same basis,

showing a difference of $178.50, and at 23 degrees C. a difference of $242.34. I want to state that these cases I just testified to were all selected by the Government, with a view of showing how slight a difference could be found.

By Mr. PLATT:

Q. How do you know that?

A. Mr. Jacobs was the man who selected them and he told me.

Q. Are you in the employ of the American Sugar Refining Company?

A. Yes, sir.

The WITNESS: The "Gladiolus," the one which I selected, shows a difference of $458.81, and $518.70 by the other, on the average of 23.25 or 24 degrees C., as testified to by the different witnesses.

By Mr. PLATT:

Q. All these four statements were made up on the same assumed basis?

A. Yes, made up on the same basis.

Mr. CLOSSON: I offer in evidence the four statements produced by the witness and about which he has just testified.

Said statements received in evidence and marked collectively "Ex. 10 for importers."

Said statements are as follows:

516 "'Cameo,' Bartram Bros., ent'd Jan'y 5, '98.

Tests Made Jan'y 10, 14.

		Gov't. test.	Ded.	Correct test.
	187 bgs.	93.70	0.15	93.55
	450 bgs.	87.35	.15	87.20
	196 bgs.	82.5865	.15	82.4365
333 B	50 hhds.	83.90	.15	83.75
113	17 hhds.	81.10	.15	80.95
	1279 bgs.	86.10		
	Average temp.	22.5° C.		
	400,000 lbs., at 86.10	5354.00		
	85.95	5332.80		
		21.20		
	at 23° C.	23.08."		

"'Santiago,' B. H. Howell, Son & Co., ent'd Jan'y 14, '98.

Tests Made Jan'y 27, 28, 29, 31.

	Gov't. test.	Ded.	Corrected test.
4000 bgs	97.74642	0.11625	97.63017
1393 bgs	95.72178	0.11625	95.60553
1407 bgs	96.30915	0.11625	96.19290
400 bgs	95.525	0.11625	95.40875
7200 bgs	96.9502		
Average temp.	21.375° C.	88.00	
Average temp.	23.		125."

517 "'Aloedene,' A. S. R. Co., Ent'd Feb'y 2, '98.

Tests Made Feb'y 4, 5, 7.

	Gov't. test.	Ded.	Corrected test.
2267 bgs	95.72633	0.12	95.60633
13 bgs	94.925	0.12	94.805
615 bgs	96.35855	0.12	96.23855
5 bgs	95.95	0.12	95.83
1197 bgs	95.85436	0.12	95.73436
53 bgs	95.475	0.12	95.355
832 bgs	95.435	0.12	95.315
18 bgs	94.70	0.12	94.58
4395 bgs	93.94843	0.12	93.82843
55 bgs	93.50	0.12	93.38
1195 bgs	96.35859	0.12	96.23859
5 bgs	96.225	0.12	96.105
2196 bgs	96.45707	0.12	96.33707
54 bgs	95.575	0.12	95.455
1098 bgs	96.10277	0.12	95.98277
2 bgs	95.125	0.12	95.005
14,000 bgs	95.377		
	Duty at 1.66319		69,853.98
Aver. temp. 21.5° C.	Duty at 1.65894		69,675.48
			178.50
at 23° C.			$242.34."

"'Gladiolus,' A. S. R. Co., Ent'd Ap'l 16, '98.

Tests Made Ap'l 27, 28, 29.

	Gov't. test.	Ded.	Corrected test.
2023 bgs	96.60	.1725	96.4275
4500 bgs	96.8381	.1725	96.6656
9329 bgs	97.03939	.1725	96.86689
7509 bgs	96.7548	.1725	96.5823
1929 bgs	97.875	.1725	97.7025
25,290 bgs	96.9468		
Average temp	23.25° C.	458.81	
Average temp	24	518.70."	

518 Examination of witness SHERER continued:

By Mr. CLOSSON:

Q. Have you made a calculation of the approximate amount of increased duties paid annually by the American Sugar Refining Company in consequence of the enforcement of these resolutions?

Mr. PLATT: I object to this; this is a case in court; this is confined to what is here. I object to that question as immaterial.

Objection overruled; exception.

A. I have for one year only, the year 1900.

Q. State what is the result for that year?

A. The increased duty would be $147,000 for that year, for the American Sugar Refining Company for that year.

By Mr. PLATT:

Q. On that same basis?

A. On the same basis.

Q. Are you a brother of the last witness?

A. Yes, sir.

Q. Are you both in the employ of the American Sugar Refining Company?

A. My brother is not and never has been.

Q. You are?

A. I am, for this purpose.

By Mr. CLOSSON:

Q. You are also an independent chemist, are you not?

A. Yes, sir. My order is to look after the American Sugar Refining Company in the matter of appraisements to prevent as much as possible the exaction of illegal duties.

By Mr. PLATT:

Q. Did you go around and get this information from these various witnesses before they were subpœnaed, all the witnesses that have been produced here this morning?

A. Not before they were subpœnaed.

Q. At the time they were subpœnaed?

A. At the time they had received their subpœnas when I got the information.

HARVEY W. WILEY, recalled as a witness, on behalf of the United States, testified as follows:

By Mr. PLATT:

Q. Doctor, you have heard the testimony here in regard to the average temperature, finding the average temperature of one room by a record of the average temperature of another room?

519 A. Yes, sir.

Q. Is that an accurate test?

A. No, sir; it isn't a test at all; you can't determine the temperature of one room by taking the temperature of another; it is impossible; there may be a difference in the heating capacity of the two rooms; the radiator may be off in one room and on in the other; the windows may be open in one room and closed in the other; there is absolutely no relation between the two.

Q. Can you get the accurate temperature of a room by taking the temperature of a liquid in a room?

A. Only in the circumstance where the temperature of the room has remained constant for a great number of hours and the volume of liquid is comparatively small. In the morning I have often noticed, in taking the temperature of a liquid in a room, I have known a difference of five or six degrees between the liquid in the morning and the temperature in the room. There is no relation between them excepting in the circumstances of which I have spoken. In the winter time especially there is a great difficulty, because the rooms are cold during the night and the steam is turned on in the morning. The specific heat of water for instance is the highest of any known substance; the specific heat of air is only about one-thirtieth of that of water; therefore, air in contact with water at a different temperature gives its temperature to the water very slowly on account of the high specific heat of water. It is only after many *many* hours of standing unchanged that the two temperatures will be the same. In the temperature of distillates which are taken, the actual temperature of the distillate when it is received is the temperature of the cooling liquid on the condenser, and not the temperature of the room. Therefore, taking the temperature of a liquid before distillation and *taken* the temperature of the distillate after gives you no idea of the temperature of the room whatever.

Q. Now, referring to the testimony of Dr. Wiechmann in relation his criticism of Dr. Schonrock, have you recently seen the production by Dr. Schonrock printed in the *Zeitschrift des Vereins der Deutschen Zucker Industrie*, referring to the position of Dr. Wiechmann in relation to the influence of temperature on the polarization of sugar?

A. I have Dr. Schonrock's publication, published in volume 51, section 541, of the journal mentioned, in answer to Dr. Wiechmann's criticism of his position.

Q. What is the date of that?
A. February, 1901.
Q. Where was it printed?
A. In Berlin.
Q. In what language?
A. German.
Q. And have you made a translation of it in English?
A. I have.
520 Q. Have you got that with you?
A. Yes; this is the original in German (producing a paper), and this is the translation of it (producing another paper).

Mr. PLATT: I offer both the original and the translation in evidence.

The WITNESS: I may say that Dr. Wiechmann's paper, to which this is a reply, was admitted in evidence at our last session (referring to "Exhibit I for Government").

Mr. CLOSSON: I object to the admission of these papers, on the ground that it is not competent to put in evidence an unverified article of a scientific expert who is not produced for cross-examination.

Objection overruled; exception.

Said papers received in evidence and marked, the original as "Exhibit J, for Government," and the translation as "Exhibit J-1 for Government."

Q. Something was said in the testimony of Dr. Wiechmann about Prof. Herzfeld agreeing with him in regard to this matter at the conference in Paris and thereafter; have you since that time received any communication from Prof. Herzfeld on that subject?
A. I have.
Q. Have you got the letter with you?
A. Yes, sir.
Q. Please produce it.
(Witness produces a paper.)
Q. What is the date of it?
A. The 13th of April, 1901, at the laboratory of the Society of the German Sugar Industry. Dr. Herzfeld is the head of that laboratory.
Q. Have you got a translation of that letter?
A. Yes, sir (producing a paper).
Q. That refers to an article in the *Vereinszeitschrift* for 1899, volume 2, page 1?
A. Yes; which has also been introduced in evidence here.
Q. That article was by him?
A. Article by Prof. Herzfeld, which was introduced here.

Mr. PLATT: I offer in evidence this letter from Prof. Herzfeld, dated April 13, 1901, and also the translation of it.

Mr. CLOSSON: I object on the same grounds as stated to the last offer of a paper, that the letter is heresay and incompetent, and on the ground that Dr. Herzfeld is not produced for cross-examination.

Objection overruled; exception.

Said letter and translation thereof received in evidence; original marked "Exhibit K for Government," and translation marked "Exhibit K–1 for Government."

521 By Mr. CLOSSON:

Q. Have you also seen and have you with you, Dr. Wiley, the reply published by Dr. Wiechmann to the article that you have produced of Dr. Schonrock (Exhibits J and J-1 for Government)?

A. I have it here; it is in this issue of March, 1901, of the *Zeitschrift des Vereins der Deutschen Zucker-Industrie* (producing said publication).

Q. Is it in German?

A. In German; and I have made a translation of it also.

Mr. CLOSSON: I offer in evidence this article by Dr. Wiechmann in the journal refered to, and the translation thereof.

Said publication and translation received in evidence; original marked "Exhibit 11 for Importers" and translation marked "Exhibit 11-*a* for Importers."

The WITNESS: It is, I believe, a fact, that Dr. Weichmann's article was submitted to Dr. Schonrock in advance of publication and Dr. Schonrock's reply was published at the same time.

Mr. PLATT: I offer in evidence Dr. Schonrock's rejoinder and the translation thereof.

Said papers received in evidence. The original is contained in "Exhibit 11 for Importers." The translation thereof is marked "Exhibit L for Government."

It is stipulated by and between counsel herein that "Exhibit 11 for Importers" may be returned by the stenographer to Dr. Wiley, and that the translation thereof (Exhibit 11-*a* for Importers and Exhibit L for Government) shall be retained and used in its stead.

EDWARD SHERER, recalled as a witness, testified as follows:

By Mr. CLOSSON:

Q. You testified as to noting certain temperatures when the tests referred to were taken?

A. Yes.

Q. What were the temperatures which you noted, the temperatures of the solutions polarized, or the temperatures of the room, or both, which?

A. It was the temperature of the solutions when polarized, and also of the room of the instrument being taken together, the solutions at exactly the temperature of the instrument and the room before the polarizations were taken.

Q. So that all the temperatures were the same?

A. Yes.

Q. Dr. Wiley has testified to the effect that the specific heat of water is greater than that of any known substance?

A. What Dr. Wiley stated was certainly true, that the liquid would have to stand for some time before it would get to the tem-

perature of the room; but precaution was always taken by
522 us to secure uniformity in the temperature of the solutions and of the room.

Adjourned.

No. 2918.

BARTRAM BROS.
vs.
THE UNITED STATES.

No. 2919.

BENJAMIN HOWELL, SON & CO.
vs.
SAME.

No. 2920.

THE AMERICAN SUGAR REFINING CO.
vs.
SAME.

Hearing resumed May 28, 1901.

Before Hon. William B. Howell, as officer of the court.

Appearances.

For the importers, H. B. Closson.
For the United States, Henry C. Platt, assistant U. S. attorney.

FERDINAND G. WIECHMANN, recalled as a witnes, testified as follows:

By Mr. CLOSSON:

Q. Do you personally know Prof. Herzfeld?
A. I do, sir.
Q. What is his full name?
A. Prof. Dr. Alexander Herzfeld, of Berlin, Germany.
Q. You have met him and had correspondence with him during the past few years?
A. I have sir.
Q. Have you from time to time during the last few years received letters from him relating in part to the questions at issue in this proceeding?
A. I have.
Q. How many such letters have you?
A. I can't state the exact number; there may have been possibly ten or a dozen.

Q. Have you produced certain of them at my request?
A. I have (producing certain letters).
Q. How many of them have you here? Give the dates of each of them.

523 A. The first one bears the date of September 19, 1898, the second one bears the date December 1st, 1898; the third bears the date of December 12, 1898; the fourth bears the date February 7th, 1900; the fifth bears the date November 17, 1900.

Q. There are five in all?
A. Five in all; yes.
Q. They were received by you in due course of mail shortly after they were written?
A. They were.
Q. The originals are in German?
A. Yes, sir.
Q. Have you the originals with you?
A. Yes, sir (referring to letters produced as above).
Q. Have you made accurate translations of them, of so much of them as relates to the questions here?
A. I have, sir.

Mr. CLOSSON: I offer in evidence the original letters and Dr. Wiechmann's translation of them.

Q. The parts that are not translated relate to other matters entirely?
A. Partly personal matters.

By Mr. PLATT:

Q. You have only furnished certain extracts from these letters?
A. I have, yes, sir, as much as I thought had any bearing upon the case at issue. You are welcome to them all.

Mr. PLATT: I object to the introduction of these letters as irrelevant and incompetent.
Objection overruled; exception.
Mr. CLOSSON: I ask to have these translations of letters dated Nov. 17, 1900; February 7, 1900; Dec. 12, 1898; Dec. 1, 1898, and Sept. 19, 1898, marked in evidence.
Said translations received in evidence and marked Exhibits 12-*a*, 12-*b*, 12-*c*, 12-*d* and 12-*e*, for Importers, respectively.
Mr. CLOSSON: I offer in evidence a letter dated August 24, 1900, addressed by the United States attorney for the southern district of New York to the attorneys for the importers in these cases, and also a letter from the attorneys for the importers to the United States attorney, dated August 15, 1900, to which it is a reply.
Mr. PLATT: I object to the introduction of these letters; they are not a rebuttal of any testimony and have no relevancy whatever to any issue in these cases.
Objection sustained.
Mr. CLOSSON: I offer to show by the letters in question that on the 15th of August, 1900, the importers offered in writing to the

counsel for the Government to agree that the question as to the influence of temperature upon the rotatory power of sugar and whether an allowance should be made therefor in polarization, as
524 provided by the United States Treasury regulations, should be submitted to the National Academy of Sciences, the decision of that body to be accepted as conclusive by both parties, and that the proposition was declined by the United States attorney.

Adjourned without fixing date.

Importers rest.

Testimony closed.

Dated June 20, 1901.

LELAND N. WOOD,
Stenographer.

EXHIBIT A.

Annual Report of E. E. H. Francis, 1883.

Suit No. 2918, &c.

Bartram Bros. *v.* U. S.

Ex. A, Feb. 1, 1900.

BRITISH GUIANA.

REPORT

ANALYTICAL CHEMIST

No. 25 of 1883.

Printed by the authority of his excellency the governor.

Demerara:
Printed at the "Royal Gazette" office, Main street.
1884.

GOVERNMENT LABORATORY, *19th May*, 1884.

SIR: I have the honor to forward herewith my annual report for the year 1883. I regret that it has been delayed so long, but I have been much occupied with other matters.

I have, &c., ERNEST E. H. FRANCIS.

The Honorable Francis Villiers, C. M. G., acting government secretary.

Report No. 25 of 1883.
Analytical chemist.

The following investigations have been made on behalf of the police and other government departments during the year 1883:

27th January.—Examination for bismuth of 8 packages
525 of powders, 1 box of pills and 2 boxes of ointment, brought by P. C. 395 Cox from Inspector Bolton. (Case of deceased De Freitas reported last year, December 30th.)

Results.—No bismuth present in any of the articles.

1st March.—Estimation of amount of proof spirit in sample of "methylated finish" received from the comptroller of customs.

Results.—Sample contained spirit equal to 162 per cent. of proof spirit.

9th May.—Examination of florin suspected to me counterfeit, received from Inspector R. T. Wright.

Results.—Coin made of tin and lead, contained no silver.

12th May.—Examination for blood stains of cutlass, 2 babas, shirt, red handkerchief, and piece of cloth, brought by P. C. 392 Burke from Inspector Lamb.

Results.—The stains on cutlass resembled blood, but were found to be merely iron rust. A few spots of blood (5 or 6) were found on the piece of cloth, none on the other articles.

16th May.—Analysis of brown resinous-looking substance received from comptroller of customs.

Results.—The substance was found to be impure silicate of soda or "water-glass."

25th May.—Examination for poison of child's stomach and contents, brought by P. C. 530 Sampson from Inspector Wright.

Results.—No poison present.

28th May.—Examination for poison of stomach and contents and liver of boy, also parcel of flour and a tin can, brought by P. C. 122 Greene from Inspector Francis.

Results.—A quantity of poisonous salt of copper was present in the contents of stomach, tissues of stomach and liver. Altogether about 0.4 grain of copper was found, equal to about 1.5 grains of sulphate of copper or blue vitriol. No poison was found in the flour, but metallic copper was found deposited on the sides of the cooking tin.

17th July.—Examination for poison of contents of stomach of coolie, brought by P. C. 514 Anderson from Mr. Plummer, S. J. P.

Results.—Contents of stomach contained small quantity of meconic acid and one grain of morphia, representing about 15 grains of ordinary opium.

24th July.—Examination for poison of human stomach, brought by P. C. 357 Underwood from Doctor Widdup.

Analytical chemist.

Results.—Small quantity of salt of mercury present in the contents of stomach, but no other poison. The presence of mercury was subsequently accounted for by the sick nurse having given calomel to the deceased.

9th August.—Examination for blood stains of 3 grass knives and 1 striped shirt, brought by Sergt. John Phillips from Inspector R. T. Wright.

Results.—No blood present.

24th August.—Examination for poison of contents of
526 human stomach and small phial brought from Colonial hospital, by Sergt. McNicholl.

Results.—Phial contained tincture of opium (or laudanum) and contents of stomach showed presence of the same drug.

4th September.—Examination for poison of contents of stomach of coolie, brought by P. C. 298, nurse from Inspector R. T. Wright.

Results.—Contents of stomach contained small quantity of meconic acid and about 2 grains of morphia, representing about 30 grains of ordinary opium.

26th September.—Examination for poison of stomach and contents, liver, kidneys, spleen and brain, also bottle of vomit brought by Corporal McNicholl, from Dr. Fisher, at the Colonial hospital.

Results.—The contents of the stomach, all the viscera and the vomit were found to contain antimony—the poisonous metal in tartar-emetic. It was proved that the latter had been sold in mistake for cream of tartar.

28th September.—Examination for poison of stomach and contents, portion of liver and kidney of coolie, brought by P. C. 432, Cadogan, from Inspector Harragin.

Results.—The contents of the stomach yielded about 0.5 grain of morphia, representing 6 to 8 grains of ordinary opium.

26th October.—Examination for poison of tin pan containing cooked rice brought by P. C. 115, Austin, from Inspector R. T. Wright.

Results.—No poison present.

6th November.—Examination for blood stains of 2 silver neck rings, 2 silver bangles, 2 cutlasses, 1 stick, muslin dress, coolie jacket, 2 pieces of netting and white skirt.

Results.—Found much blood on muslin dress and small quantity on one piece of netting. The silver rings and bangles were also stained with blood that had been altered by exposure to the action of heat. No blood on the other articles.

26th November.—Examination for a spirit of a drum of French polish, a drum of copal varnish, and a drum of oak varnish. Received from the acting comptroller of customs.

Results.—The French polish contained methylated spirit,* the copal and oak varnish contained no spirit.

13th November.—Examination for blood stains of small knife brought by Inspector E. F. Wright.

Results.—No blood present.

527 Full written reports on the above cases have been furnished and inquests and trials have been attended when necessary in different parts of the colony.

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*It is respectfully suggested by the reporter that varnish, &c., made with methylated spirit might be exempted from the high duty levied on pure alcoholic preparations. Also that some provision might be made for admitting benzoline (gasoline or petroleum spirit) at a low duty into the colony. Benzoline is a cheap and very useful liquid. It forms the best material for producing illuminating gas in the portable gas apparatus that are now much used, and can also be profitably employed in extracting caoutchouc, resins, oils, &c., from plants, but hitherto the prohibitive duty of $3.00 per gallon has prevented its importation except in very small quantities.

Five hundred and forty-three samples of mineral oil, representing 80 consignments have been tested during the year for the customs department. Of these 514 samples representing 75 consignments were found to have a flash point *above*, and 29 samples, representing 5 consignments, a flash point *below* the standard fixed by the tax ordinance, viz., 73 degrees Fahrenheit, when tested by the apparatus described in the imperial act 42 and 43 Vict. c. 47.

To the strict enforcement of the provisions of the tax ordinance relating to inflammable oil may be attributed the almost complete cessation during the past two years of the accidents and petty fires arising from the explosion of kerosene lamps that were formerly so frequent.

A large number of samples of sugar (473) were tested by the polariscope for merchants and others, chiefly during the last half of the year.

Great pains were taken in verifying the principal degrees on the scale of the laboratory polariscope to insure their correctness and also that of the graduations on the measuring flasks and other apparatus used in the examination of sugar samples, so that no difficulty is now found in estimating the percentage of sugar in a sample to within about one-tenth of one per cent. of the truth. In other words, the experimental error in determining the weight of pure sugar in a hogshead containing two thousand pounds of commercial sugar would hardly exceed two pounds.

There were also submitted for analysis about 60 samples of miscellaneous substances comprising soils, waters, wines, canes, cane-juice, syrup, skimmings, wash, molasses, urine, bloomer, guano, gypsum, sulphate of ammonia, bone-black and other manures, gold-quartz and other minerals, &c.

A number of samples of wash, rum, molasses, &c., not included above were also examined in connection with certain experiments on fermentation that were being carried out by the Hon'ble W. Russell, and Mr. W. S. Turner, chief commissary, conjointly.

Lectures and lessons were given at Queen's college throughout the academical year—twice a week during the first two terms and thrice a week during the third. The transport of apparatus for each lecture to and from the laboratory caused much inconvenience and waste of time; but of course this cannot be remedied until it is found expedient to establish the laboratory in connection with the college.

From March 7th to May 3rd, the reporter was absent on leave from the colony, and Mr. C. Williams, F. C. S., acted in his stead.

The foregoing is an outline of the routine work done in the laboratory during the past year, and it will be evident that but little time was available for new investigations, nevertheless, a
528 small amount of original research was accomplished during the rare intervals of leisure.

Firstly,—a large quantity of the new sugar laurite or lauritol has been prepared from the seeds of the avocado pear tree. Formerly, the bark of the tree was used to furnish the sugar and as the tree is very scarce in the colony a quantity of the bark (about 4 cwt.) was imported from one of the islands.

Unfortunately after much care and trouble had been expended in extracting the substance, the yield of sugar was found to be almost *nil*. The fruit of the tree was then looked to as a source of the substance, and it was ascertained that the green fruit contained the sugar both in the fleshy portion and also in the seed, but when ripe the seed only yielded the new sugar, ordinary glucose having apparently taken the place of laurite in the edible part. The ripe seed was found to yield from 0.5 to 1 per cent. of laurite.

Between 300 and 400 pounds of the seeds were collected in small quantities during the season of last year, and the laurite was extracted from them and thoroughly purified.

A sufficiently large quantity of the pure substance is now on hand at the laboratory to enable its properties to be thoroughly examined. (A sample has been already forwarded to Mr. Jenman to Kew Gardens at the request of the authorities there.) As mentioned in a previous notice respecting this sugar the determination of its right name and place amongst other compounds depended chiefly upon the results of its behavior when distilled with hydriodic acid. The substances that laurite most resembles, namely, mannite and dulcite, yield a compound called iodide of hexyl $C_6 H_{13} I$ when treated in that manner, and both man-ite and dulcite were thus proved to be derivatives of the hydro-carbon hexane $C_6 H_{14}$. Repeated attempts failed to produce the same reaction with laurite until at last it was found that by distilling the substances with iodine, phosphorus and water, instead of with hydriodic acid, the desired change was effected and a small quantity of liquid was obtained that in general appearance resembled iodide of hexyl, but was quite different in chemical composition. As far as can be judged at present this new liquid is iodide of duodecyl $C_{12} H_{25} I$, containing twelve atoms of carbon instead of six.* Several other properties possessed by laurite and several new compounds obtained from it have been examined the particulars of which need not be detailed here.

Experiments were also renewed during last year in connection with the purification of lamaha water, and resulted in the use of lime instead of carbonate of soda in the process, whereby a great saving in expense would be effected. The cost of materials for purifying a million gallons of water has thus been reduced to about
$15.50. There was also devised an almost automatic system
529 for carrying out the purification on the large scale, particulars of which have already been published in Timehri—the journal of the Royal Agricultural and Commercial Society of British Guiana.

Samples from each of a number of varieties of trial sugar canes grown at the botanical gardens and forwarded by Mr. G. S. Jenman, the Government botanist, were analyzed in order to ascertain which were the best for cultivation. A creole cane from Plantation Bel Air, was also forwarded for comparison. The description and results of the analysis of the different varieties are as follows:

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*Subsequent experiments have shown that this surmise is wrong and that the liquid obtained was a mixture, apparently of iodide of hexyl and a hydrocarbon, having nearly the same percentage composition as iodid- of duodecyl.

I.—Singapore elephant cane (plants).

Colour.—Greenish-yellow with dark-red shading. Length of cane 2.489 metres. Average length of internoder 11–12 centimetres. Diameter of cane 4–5 centimetres. Weight of stripped cane 3394 grammes. Percentage of juice expressed by mill 73.45 containing 39.9 per cent. of total sugar. Specific gravity of juice 1071 equal to 9.5 degrees Bm. Direct polarization of juice 60.28° equal to 157.03 grammes of sucrose per litre.†

Composition of juice.		Composition of cane.	
‡Sucrose	14.92	Sucrose	12.30
Glucose	0.93	Glucose	.64
Salts (ash)	.62	Salts (ash)	.54
Water, &c.	83.53	Fibre (less ash)	11.61
		Water, &c.	74.01
	100.00		100.00

II.—Singapore elephant cane (ratoons).

Colour.—Greenish yellow with red shading. Length of cane 2.136 metres. Average length of internodes 10 centimetres. Diameter of cane 4–5 centimetres. Weight of stripped cane 3185 grammes. Percentage of juice expressed by mill 64.17 containing 76.38 per cent. of total sugar in cane. Specific gravity of juice 1070 equal to 9.4 deg. Bm. Direct polarization of juice 54.78 deg. equal to 142.7 grammes of sucrose per litre.

530

Composition of juice.		Composition of cane.	
Sucrose	13.83	Sucrose	11.70
Glucose	1.80	Glucose	1.43
Salts (ash)	.78	Salts (ash)	.80
Water, &c.	83.59	Fibre (less ash)	12.87
		Water, &c.	73.20
	100.00		100.00

III.—Barbados elephant cane (plants).

Colour.—Dark green shaded with purple, epidermis covered with waxy bloom (cerosin). Length of cane 2.032 metres. Average length of internodes 6–8 centimetres. Diameter of cane about 6

†Each degree of the polariscope used (Soleil-Ventzke-Scheibler) represents .2605 gramme sugar in the cubic centimetre of juice.

‡A correction equal to 0.28 times the glucose is added to cane sugar is an allowance for the amount of sugar masked by the presence of the glucose in the juice polarized

centimetres. Weight of stripped cane 5,094 grammes. Cane very brittle, broke in short pieces on passing through mill and was in consequence very difficult to grind. Percentage of juice expressed by mill 55.73, containing 73.60 per cent. of total sugar in cane. Specific gravity of juice 1078, equal to 10.4 Bm. Direct polarization of juice 66.33 deg., equal to 172.6 grammes of sucrose per litre.

Composition of juice.		Composition of cane.	
Sucrose	16.31	Sucrose	12.36
Glucose	0.37	Glucose	0.27
Salts (ash)	0.75	Salts (ash)	0.70
Water, &c.	82.57	Fibre (less ash)	13.42
		Water, &c.	73.25
	100.00		100.00

IV.—Barbados elephant cane (ratoons).

Colour.—Dark green with purple shading and abundant waxy bloom. Length of cane 1.651 metres. Average length of internodes 9–10 centimetres. Diameter of cane about 5 centimetres. Weight of stripped cane 2,817 grammes. Cane very brittle. Percentage of juice expressed in mill 66.62 containing 81.39 per cent. of total sugar in cane. Specific gravity of juice 1084 equal to 11.2 deg. Bm. Direct polarization of juice 67.98 deg. equal to 177.1 grammes of sucrose per litre.

Composition of juice.		Composition of cane.	
Sucrose	16.49	Sucrose	13.58
Glucose	0.60	Glucose	0.40
Salts (ash)	0.84	Salts (ash)	0.89
Water, &c.	82.07	Fibre (less ash)	12.43
		Water, &c.	72.69
	100.00		100.00

531 V.—Honolulu cane (plants).

Colour.—Greenish yellow, every joint cracked longitudinally. Length of cane 2.184 metres. Average length of internodes 9.5 centimetres. Diameter of cane 4.3 centimetres. Weight of stripped cane 2,890 grammes. Percentage of juice expressed by mill 59.06 containing 73.01 per cent. of total sugar in cane. Specific gravity of juice 1084 equal to 11.2 deg. Bm. Direct polarization of juice 77.44 deg. equal 201.7 grammes of sucrose per litre.

Composition of juice.		Composition of cane.	
Sucrose	18.63	Sucrose	15.04
Glucose	0.21	Glucose	0.20
Salts (ash)	0.80	Salts (ash)	0.81
Water, &c	80.36	Fibre (less ash)	12.28
		Water, &c	71.67
	100.00		100.00

VI.—Honolulu canes (ratoons).

Colour.—Greenish-yellow, every joint cracked longitudinally. Length of cane 2.108 metres. Lenth of internodes, 7–9 centimetres. Diameter of canes 4.4 centimetres. Weight of stripped cane 3,070 grammes. Percentage of juice expressed in mill 64.35 containing 78.72 per cent. of total sugar in cane. Density of juice 1,091, equal 12 deg. Bm. Direct polarization of juice 77.99 deg., equal to 203.0 grammes of sucrose per litre.

Composition of juice.		Composition of cane.	
Sucrose	18.71	Sucrose	15.32
Glucose	.35	Glucose	.26
Salt- (ash)	.87	Salts (ash)	.99
Water, &c	80.07	Fibre (less ash)	12.23
		Water, &c	71.20
	100.00		100.00

VII.—Mauritius cane (plants).

Colour.—Light greenish yellow with red shading, each joint cracked longitudinally. Length of cane 1.930 metres. Average length of internodes 10 centimetres. Diameter of cane about 4.8 centimetres. Weight of stripped cane 2,990 grammes. Percentage of juice expressed in mill 68.64 containing 84.87 per cent. of total sugar in cane. Specific gravity of juice 1,072, equal to 9.7 deg. Bm. Direct polarization of juice 61.49 deg. equal to 160.2 grammes of sucrose per litre.

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Composition of juice.		Composition of cane.	
Sucrose	15.12	Sucrose	12.28
Glucose	.67	Glucose	.49
Salts (ash)	.54	Salts (ash)	.84
Water, &c	83.67	Fibre (less ash)	9.79
		Water, &c	76.60
	100.00		100.00

VIII.—Mauritius cane (plants).

Colour.—Light yellow with green and red shading, joints cracked longitudinally. Length of cane 2.235 metres. Length of internodes 11–16 centimetres. Diameter of cane about 3.5 centimetres. Weight of stripped cane 2360 grammes. Percentage of juice expressed in mill 72.4 containing 86.08 per cent. of total sugar in cane. Density of juice 1070, equal to 9.4 deg. Bm. Direct polarization of juice 62.37 deg., equal to 162.5 grammes of sucrose per litre.

Composition of juice.		Composition of cane.	
Sucrose	15.34	Sucrose	12.93
Glucose	.58	Glucose	.46
Salts (ash)	.55	Salts (ash)	.73
Water, &c.	83.53	Fibre (less ash)	10.06
		Water, &c.	75.82
	100.00		100.00

IX.—Creole cane (from Pln. Bel Air).

Colour.—Bright yellow with patches of red shading. Length of cane 2.184 metres. Length of internodes 9–11 centimetres. Diameter of cane 4.2 to 4.5 centimetres. Weight of stripped cane 3321 grammes. Percentage of juice expressed in mill 60.9, containing 76.0 per cent. of total sugar in cane. Specific gravity of juice 1083, equal to 11.0 deg. Bm. Direct polarization of juice 75.57 deg., equal to 196.8 grammes of sucrose per litre.

Composition of juice.		Composition of cane.	
Sucrose	18.36	Sucrose	14.52
Glucose	0.67	Glucose	0.71
Salts (ash)	0.31	Salts (ash)	0.43
Water, &c.	80.65	Fibre (less ash)	13.13
		Water, &c.	71.21
	100.00		100.00

533 The preceding form the first of a series of analyses of trial canes that it is proposed to continue if possible during succeeding years. The analyses have been made with great care and are of a strictly practical nature; inasmuch as they have been performed upon the whole can- instead of on merely a portion as is customary. Thus all doubt is removed that the composition of the cane is fairly represented by the sample analyzed. Certain special apparatus required for these analyses was imported last year for the government laboratory and included a balance by Becker capable of carrying 20 kilogrammes and turning with 0.1 gramme or 1/200000

of its load, also a large gas oven for drying the megass, &c. The mill employed was kindly lent by the Hon'ble W. Russell, and although a hand-mill, it proved to be a most efficient machine that gave crushing results fully equalling the steam mills used on the estates.

It will be evident from the analyses that the Honolulu cane is by far the best of the varieties from a chemical aspect; moreover, according to Mr. Jenman, the government botanist, it is hardy and otherwise of a good habit of growth. The only cane that approached the Honolulu variety in saccharine richness was the one from Pln. *Bel Air*, but this native cane was a magnificent and without doubt an unusual specimen of the sugar cane of the colony. However this may be, the Honolulu cane is exceptionally good, and deserves a strong recommendation for trial by planters. The celebrated Barbadoes Elephant cane is rather disappointing both in its saccharine richness and also in the percentage of juice it yields.

The Mauritius canes are apparently below the average of canes grown in that island, for according to Dr. Icery the average composition of the juice of ripe Mauritius cane is:

Sugar	18.36
Salts	0.29
Other organic matter	.35
Water	81.00
	100.00

Dr. Icery's original memoir is not at hand and his mode of stating results can only be inferred indirectly. But to take the first example in the long list of analyses of Mauritius cane juice furnished by him and published in most books treating of sugar, we find that the Bellouguet plant canes from *La Gaieté* estate gave juice of 9.10 degrees Bm., equal to a specific gravity of 1068. The direct polarisation of the juice was 85.8 degrees and from this the *"equivalent percentage"* of sugar in the juice is given as 14.00.* As a matter of fact, however, this is not the real per centage of sugar in the juice at all, but only the number of parts of sugar by weight in 100 parts of juice by measure. To ascertain the real per centage
534 of sugar from the indications of the polariscope, the results of the reading must be multiplied by 1000 and be divided by the specific gravity of the juice. Amended in this way Dr. Icery's 14 per cent. of sugar becomes reduced to 13.10 per cent. This essential correction appears to have been neglected all through Dr. Icery's table and leads to the inference that it has also been lost sight of in calculating the per centage of sugar in the average cane juice given above. But an average juice containing 18.36 parts of sugar by weight in 100 parts of juice by measure would have a

*The polariscope used by Dr. Icery was apparently one in which each degree represented 1635 grammes of sucrose in 1 cubic centimetre of liquid examined—probably either a Soleil or a Duboscq instrument.

specific gravity of about 1074 equal to 10 degrees Bm., and the real per centage of sugar in it would only be 17.09—thus bringing the results much nearer to those obtained from the Mauritius canes grown at the botanical gardens here.

A point worthy of remark in respect to the composition of the above trial canes is the relatively large amount of salts or mineral matter they all contain, this is probably owing to the newness of the soil in which they were grown, and subsequent crops will no doubt show a decrease.

Several other matters have been investigated in the government laboratory during the past year, especially in the direction of simplifying the modes of analysing soils and manures whereby a great saving in time and trouble and consequently in expense has been effected. Also in rendering the processes for the detection of the more prevalent vegetable poisons—such as datura and opium—more simple and certain. These matters are, however, purely technical and it would be useless to give any description of them in this report.

ERNEST E. H. FRANCIS,
Gov't Analytical Chemist.

535 EXHIBIT B.

Annual Report of E. E. H. Francis, 1886.

Suit No. 2918 & others, Bartram Bros. *v.* U. S.

British Guiana.

REPORT

OF THE

GOVERNMENT ANALYTICAL CHEMIST

FOR THE YEAR

1886.

Printed by the authority of his excellency the governor.

Georgetown, Demerara:
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1887.

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GEORGETOWN, *30th July*, 1887.

SIR: I have the honour herewith to forward my annual report for 1886.

I have the honour to be, sir, your obedient servant,

E. E. H. FRANCIS,
Gov't Analytical Chemist.

The Hon'ble Francis Villiers, C. M. G., acting government secretary.

Report of the Government Analytical Chemist for the Year 1886.

1. The number of articles sent to the government laboratory for analysis during the year 1886 was as follows:—

For the police and medical departments, 32 articles, chiefly consisting of human *viscera*, drugs, food, &c., suspected to contain poison, the remainder being weapons and clothes to be examined for blood and other stains. For the comptroller of customs 556 samples of oil were tested, and 13 samples of drugs, tinctures, varnish, &c., were analysed. For the chief commissary 7 samples of spirituous liquors were examined. A sample of colza oil from the inspector of prisons, 13 samples of water from the public works department, and 12 samples of trial sugar canes from the botanical gar-
536 dens were also analysed. Altogether the number of samples examined on behalf of the government was 634.

Apart from oils, the number of miscellaneous analyses made was 78, as against 215 the previous year.

The usual reports and certificates on the above analyses were furnished, and personal evidence in respect to them given whenever required in courts of law.

2. In connection with the latter duty, it may here be mentioned that the work of the government analyst would be greatly facilitated if his written report could be received in place of personal evidence at magistrates' and coroners' inquiries. Amongst the inconveniences that arise from the absence of the analyst from the laboratory on such duty, are the frequent interruptions to the course of chemical lectures at Queen's college, which not only disturb the college routine, but retard the pupils' progress by the irregularity of the teaching. Also, the testing of mineral oils previous to their being admitted into the colony, is work that requires to be done promptly, a delay of a day or more—caused by the analyst being absent, perhaps at Essequebo or Berbice—before the testing can be done, and the consignments cleared, may make a great difference to those concerned. Perishable articles for analysis, such as milk, urine, cane juice, &c., require to be taken in hand immediately, or they become unfit for examination. Also articles sent for analysis for legal purposes, require to be received personally by the analyst, but the bearer of such articles is sometimes kept waiting for hours or even days before he can complete his errand. These and other inconveniences would be greatly lessened if the analyst's personal at-

tendance could be dispensed with, except perhaps at the supreme courts, or when counsel objected.

3. In addition to the usual teaching at Queen's college, a practical chemistry class for a limited number of the pupils was formed at the new laboratory in Charlestown, and has been regularly attended ever since—the attendance now being given after the usual school hours. Chemistry pupils always evince much greater interest in their subject when allowed to perform the manipulations themselves, and it is greatly to be regretted that the present arrangements of the college and the laboratory do not admit of more being done in that direction.

4. The reporter was absent on leave from January 1st to November 5th, Mr. Charles Williams, F. C. S., acting as government chemist during that time.

5. The following are the results of the analyses of the trial sugar canes grown at the botanical gardens during the year. They were all second ratoons and 10 to 11 months old:—

537 Chigaga.

Yellow cane. Length 2.44 metres. Internodes 8–15 centimetres. Diameter 4 centimetres. Weight 3.367 kilogrammes. Gave 65.4% juice by mill. Density of juice at 86° F. 1063=8.5° Bm. Juice contained per gallon 1.339 lbs. sucrose, 0.185 lb. glucose, .049 lb. mineral matter, .074 lb. organic matter.

100 parts by weight contained:

Juice.		Cane.		
Sucrose	12.60	Sucrose	expressed juice 8.24; residual " 2.62	10.86
Glucose	1.74	Glucose	expressed juice 1.14; residual " .55	1.69
Organic matter	0.70	Mineral matter	expressed juice .30; residual " .10; fibre .22	.62
Mineral matter	0.46	Fibre		10.42
Water	84.50	Water, &c		76.43
	100.00			100.00

Queensland creole.

Purple cane. Length 2.585 metres. Internodes 10–15 centimetres. Diameter 3 centimetres. Weight 2.138 kilogrammes. Gave 68.4% juice of density at 84° F. 1073=9.8° Bm. Juice contained per gallon 1.727 lbs. sucrose, .004 lb. glucose, 0.062 lb. mineral matter, and .106 lb. organic matter.

100 parts by weight contained:

Juice.		Cane.		
Sucrose	16.10	Sucrose	expressed juice 11.01; residual " 2.25	13.26
Glucose	0.04	Glucose	expressed " 0.03; residual " 0.01	0.04
Organic matter	0.99	Mineral mattter	expressed " 0.38; residual " 0.14; fibre 0.15	0.67
Mineral matter	0 57	Fibre		10.90
Water	82.30	Water, &c		75.13
	100.00			100.00

Rappoe.

Greenish yellow cane. Length 2.310 metres. Internodes 8-13 centimetres. Diameter 3.5 centimetres. Weight 2.137 kilogrammes. Gave 69.0% juice of density 1072=9.7° Bm. Juice contained per gallon 1.667 lb. sucrose, .062 lb. glucose, .53 lb. mineral matter, .093 lb. organic matter.

100 parts by weight contained:

Juice.		Cane.		
Sucrose	15.55	Sucrose	expressed juice 10.73, residual " 2.30	13.03
Glucose	0.58	Glucose	expressed " 0.40, residual " 0.15	0.55
Organic matter	9.87	Mineral matter	expressed " 0.34, residual " 0.09, fibre " 0.15	0.58
Mineral matter	0.50	Fibre		10.47
Water	82.50	Water, &c		75.37
	100.00			100.00

538 Striped Singapore.

Yellowish green cane with ill defined purple stripes. Length 2.530 metres. Internodes 10 to 17 centimetres. Diameters 2.8 centimetres. Weight 2.393 kilogrammes. Gave 67.8% of juice density 1075=10.1° Bm. Juice contained per gallon 1.762 lbs. sucrose, 0.20 lb. glucose, .064 lb. mineral matter, and .099 lb. organic matter.

100 parts by weight contained:

Juice.		Cane.		
Sucrose	16.39	Sucrose	expressed juice 11.11, residual " 2.80	13.91
Glucose	0.19	Glucose	expressed " 0.13, residual " 0.03	0.16
Organic matter	0.93	Mineral matter	expressed juice 0.44, residual " 0.19, fibre " 0.15	0.74
Mineral matter	0.59	Fibre		9.58
Water	81.90	Water, &c		75.61
	100.00			100.00

Meera.

Purple cane. Length 3.00 metres. Internodes 8 to 17 centimetres. Diameter 3 centimetres. Weight 2.742 kilogrammes. Gave 68.0% juice of density 1.066=8.9° Bm. Juice contained per gallon 1.495 lb. sucrose, .062 lb. glucose, .055 mineral matter and .104 lb. organic matter.

100 parts by weight contained:

Juice.		Cane.		
Sucrose	14.02	Sucrose	expressed juice 9.53, residual " 2.30	11.83
Glucose	0.59	Glucose	expressed juice 0.40, residual " 0.14	0.54
Organic matter	0.98	Mineral matter	expressed juice 0.35, residual " 0.12, fibre 0.25	0.72
Mineral matter	0.51	Fibre		9.90
Water	83.90	Water, &c		77.01
	100.00			100.00

Lahaina.

Yellowish green cane. Length 3.33 metres. Internodes 8 to 14 centimetres. Diameter 4.2 centimetres. Weight 3.736 kilogrammes. Gave 69.2% juice of density 1067=9.0° Bm. Juice contained per gallon 1.546 lb. sucrose, .062 lb. glucose, .041 lb. mineral matter and .090 lb. organic matter.

100 parts by weight contained.

Juice.		Cane.			
Sucrose	14.49	Sucrose	expressed juice 10.03 residual " 1.90	11.93	
Glucose	0.58	Glucose	expressed juice 0.40 residual " 0.07	0.47	
Organic matter	0.85	Mineral matter	expressed juice 0.26 residual " 0.18 fibre 0.14	0.58	
Mineral matter	0.38	Fibre		10.44	
Water	83.70	Water, &c		76.58	
	100.00			100.00	

539 Honolulu.

Greenish-yellow cane. Length 2.210 metres. Internodes 6–10 centimetres. Diameter 4.4 centimetres. Weight 2.761 kilogrammes. Gave 69.3% juice, density 1078 = 10.4° Bm. Juice contained per gallon 1.745 lb. sucrose, .033 lbs. glucose, .084 lb. mineral matter and .161 lb. organic matter.

100 parts by weight contained:

Juice.		Cane.			
Sucrose	16.19	Sucrose	expressed juice 11.22 residual " 2.37	13.59	
Glucose	0.33	Glucose	expressed juice 0.20 residual " 0.09	0.29	
Organic matter	1.50	Mineral matter	expressed juice 0.54 residual " 0.28 fibre 0.17	0.99	
Mineral matter	0.78	Fibre		9.80	
Water	81.20	Water, &c		75.33	
	100.00			100.00	

"Barbados elephant."

Greenish yellow with purple patches. Cane covered with waxy bloom. Length 2.077 metres. Internodes 8–10 centimetres. Diameter 4.7 centimetres. Weight 5.029 kilogrammes. Gave 77.8% juice of density 1.065 = 8.8° Bm. Juice contained per gallon 1.40 lbs. sucrose, .015 lb. glucose, .059 lb. mineral matter and .084 lb. organic matter.

100 parts by weight contained:

Juice.		Cane.			
Sucrose	13.14	Sucrose	expressed juice 10.22 residual " 0.78	11.00	
Glucose	1.42	Glucose	expressed juice 1.11 residual " 0.10	1.21	
Organic matter	0.79	Mineral matter	expressed juice .43 residual " .12 fibre .20	.75	
Mineral matter	0.55	Fibre		8.03	
Water	84.10	Water, &c		79.01	
	100.00			100.00	

"Purple Mauritius."

Nearly all purple cane. Length 2.034 metres. Internodes 9–13 centimetres. Diameter 3.5 centimetres. Weight 2.695 kilogrammes. Gave 73.5% of juice of density 1,067 = 9.0 Bm. Juice contained per gallon 1.523 lbs. sucrose, .055 lb. glucose, .070 lb. mineral matter, and .090 lb. organic matter.

100 parts by weight contained:

Juice.		Cane.		
Sucrose	14.28	Sucrose: expressed juice	10.49	12.16
Glucose	0.52	Sucrose: residual "	1.67	
Organic matter	0.84	Glucose: expressed juice	.38	.50
Mineral matter	0.66	Glucose: residual "	.12	
Water	83.70	Mineral matter: expressed juice	.48	.94
	100.00	Mineral matter: residual "	.23	
		Mineral matter: fibre	.23	
		Fibre		10.07
		Water, &c		76.33
				100.00

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"Selangore."

Greenish yellow cane with few red patches. Length 2.325 metres. Internodes 8–11 centimetres. Diameter 4.8 centimetres. Weight 3.314 kilogrammes. Gave 79.3% juice of density 1,064 = 8.7° Bm. Juice contained per gallon 1.380 lbs. sucrose, .125 lb. glucose, .075 lb. mineral matter, and .090 lb. organic matter.

100 parts by weight contained:

Juice.		Cane.		
Sucrose	12.97	Sucrose: expressed juice	10.28	11.46
Glucose	1.17	Sucrose: residual "	1.18	
Organic matter	0.85	Glucose: expressed juice	.93	1.03
Mineral matter	0.71	Glucose: residual "	.10	
Water	84.30	Mineral matter: expressed juice	.55	.91
	100.00	Mineral matter: residual "	.14	
		Mineral matter: fibre	.22	
		Fibre		8.49
		Water, &c		78.11
				100.00

"White Mauritius."

Pale greenish yellow cane. Length 2.470 metres. Internodes 7–10 centimeters. Diameter 4.3 centimeters. Weight 2.941 kilogrammes. Gave 76.1% juice of density 1,061 = 8.3° Bm. Juice contained per gallon 1.21 lbs. sucrose, .178 lb. glucose, .062 lb. mineral matter, and .132 lb. organic matter.

100 parts by weight contained:

Juice.		Cane.		
Sucrose	11.40	Sucrose: expressed juice	8.67	9.99
Glucose	1.68	Sucrose: residual "	1.32	
Organic matter	1.24	Glucose: expressed juice	1.18	1.43
Mineral matter	.58	Glucose: residual "	.25	
Water	85.10	Mineral matter: expressed juice	.44	.95
	100.00	Mineral matter: residual "	.19	
		Mineral matter: fibre	.32	
		Fibre		9.02
		Water, &c		78.61
				100.00

Keening

Light greenish yellow cane with purple red patches. Length 2.165 metres. Internodes 9–13 centimeters. Diameter 3.2 centimetres. Weight 1.750 kilogrammes. Gave 76.9 % of juice of density 1,075 = 10° Bm. Juice contained per gallon 1.575 lbs. sucrose, .083 lb. glucose, .061 lb. mineral matter and .238 lb. organic matter.

100 parts by weight contained:

Juice.		Cane.			
Sucrose	14.65	Sucrose	expressed juice 11.26; residual " 1.40		12.66
Glucose	.77	Glucose	expressed juice .59; residual " .10		.69
Organic matter	2.21?	Mineral matter	expressed juice .44; residual " .20; fibre .29		.93
Mineral matter	.57	Fibre			8.97
Water	81.80	Water, &c			76.75
	100.00				100.00

541 To compare with the foregoing, the following analysis may be given of a sample of canes grown in the laboratory ground without any particular attention. The cane selected was a very fine specimen in appearance. Topped for grinding it was 13 ft. long, and weighed about 17½ lbs.:

Colony cane.

Plants, 12 months old. Greenish yellow. Length, 3.910 metres. Internodes 9—15 centimetres. Diameter 5.4 centimetres. Weight 8.025 kilogrammes. Gave 73.8% of juice of density 1070=9.4° Bm. Juice contained per gallon 1.584 lbs. sucrose, .094 lb. glucose, .051 lb. mineral matter and .091 lb. organic matter.

100 parts by weight contained:

Juice.		Cane.			
Sucrose	14.80	Sucrose	expressed juice 10.92; residual " 1.88		12.80
Glucose	.88	Glucose	expressed juice .65; residual " .12		.77
Organic matter	.85	Mineral matter	expressed juice .35; residual " .06; fibre .12		.53
Mineral matter	.47	Fibre			10.18
Water	83.00	Water, &c			75.72
	100.00				100.00

Samples of Lahaina canes that had been grown at Pln. Enmore were also analyzed. The canes proved to be richer in sugar than those grown at the Botanical Gardens (from whence the seed plants were obtained), as the following results show:

Lahaina (Pln. Enmore).

Plants 11 months old. Yellow, with green and red patches. Length, 1.093 metres. Internodes 8—15 centimetres. Diameter 4 centimetres. Weight 2,446 kilogrammes. Gave 72.4% juice by mill of density 1076 10.2 Bm. Juice contained per gallon 1.782 lbs. sucrose, .038 lb. glucose, .066 lb. mineral matter and .094 lb. organic matter.

100 parts by weight contained :

Juice.		Cane.			
Sucrose	16.56	Sucrose	expressed juice 11.99 residual " 1.69	13.68	
Glucose	0.36	Glucose	expressed juice .26 residual " .06	.32	
Organic matter	0.87	Mineral matter	expressed juice .44 residual " .13 fibre .12	.69	
Mineral matter	0.61	Fibre			10.38
Water	81.60	Water, &c			74.93
	100.00				100.00

From the above analyses it will be seen that none of the trial canes exhibits any peculiar features, from a chemical point of view, or promises to supplant the ordinary cane. Grown under proper conditions, the common Otaheite or Bourbon cane yields abundance of juice containing as much as 1/5 of its weight of sugar,
542 and it scarcely appears likely that any better cane for the colony will be found.

The principal facts of the preceding analyses are summarized in the following table :

Name.	Per cent. of crushing.	Total sugar in cane.	Total sugar extracted.	Total sugar in megass.	Per cent. fibre.	Density of juice Baumé.
Chigaga	65.4	12.55	9.38	3.17	10.42	8.5
Queensland Creole	68.4	13.30	11.04	2.26	10.90	9.8
Rappoe	69.0	13.58	11.13	2.45	10.47	9.7
Striped Singapore	67.8	14.07	11.24	2.83	9.58	10.1
Meera	68.0	12.37	9.93	2.44	9.90	8.9
Lahaina	69.2	12.40	10.43	1.92	10.44	9.0
Honolulu	69.3	13.88	11.42	2.46	9.80	10.4
Barbadoes Elephant	77.8	12.21	11.33	0.88	8.03	8.8
Purple Mauritius	73.5	12.16	10.87	1.79	10.07	9.0
Salangore	79.3	12.49	11.21	1.28	8.49	8.7
White Mauritius	76.1	11.42	9.85	1.57	9.02	8.3
Keening	76.9	14.35	12.85	1.50	8.97	10.0
Colony cane	73.8	13.57	11.57	2.00	10.18	9.4
Lahaina	72.4	14.00	12.25	1.75	10.38	10.2
Means	71.9	13.06	11.04	2.02	9.05	9.4

From the mean figures it will be seen that 71.9% extraction of juice from average cane containing 13.06 per cent. sugar, result in 11.04 per cent. of the total sugar being obtained, 2.02 per cent. remaining in the megass. Each unit of cane juice obtained by crush-

ing therefore removes an average of .1535 per cent. of total sugar from such canes, and a proportionately larger or smaller quantity from the richer and poorer ones.

6. The following analysis of the expressed juice of leaves of mature cane may be interesting as showing the proportion of sugar present, and as being, as far as the reporter is aware, the first of the kind:—

Density 1030=4.2° Bm. 100 parts by weight contained:—

Sucrose	3.18
Glucose	.49
Ash	1.61
Organic matter	2.32
Water	92.40
	100.00

7. A fair amount of work was done during the year for merchants and others, chiefly in connection with the sugar industry. A rather large number of samples of sugar, molasses, &c., were submitted for polarization. To insure correct polarimetric readings, great pains have been taken, and numerous trial experiments made with the instruments and apparatus in use at the government laboratory.

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The polariscope principally used—now a well-tried instrument of the Soleil-Ventzke-Scheibler pattern—was sent to the makers at Berlin to be put in thorough order. On its return a long series of trial experiments was made with it to again determine the accuracy of the principal divisions marked on its scale. For that purpose pure sugar was prepared by repeatedly crystallizing purified sugar candy from alcohol of 85%, and submitting the resulting crystals to much further treatment in the way of powdering, washing with strong alcohol, and drying in air free from moisture for several weeks at the ordinary temperature. The object kept in view being to obtain the sugar free from any appreciable amount of moisture, mineral matter or glucose; and particularly to guard against the accidental *inversion* of any portion of the sugar during the treatment.

Repeated experiments with the pure substance thus obtained proved the normal weight of sugar required to polarize 100 divisions on the laboratory instrument to be 26.126 grammes dissolved in water to exactly 100 cubic centimetres, at a temperature of 28° C. The sugar weight on which the instrument is nominally graduated, at 17.5° C., is 26.048 grammes, but that weight causes a deviation of only 99.70° divisions instead of 100.

Very considerable errors may arise from the glass flasks used in making up the sugar solution to the standard volume being incorrectly marked. The flasks usually employed nominally hold either 50 or 100 cubic centimetres—a cubic centimetre being the space occupied by 1 gramme of water weighed in *vacuo* at 4° centigrade. The capacity of a flask can easily be tested by weighing it when empty

and then when filled with water to the mark, but if this is done at a higher temperature than 4° C. a correction must be applied for the loss of weight the gramme-volume of water suffers by expansion. Thus, at a temperature of 28° C., 50 true cubic centimetres of water weigh only 49.7675 grammes in *vacuo*, or 49.7665 grammes if weighed in air in the ordinary manner. Five of the laboratory flasks which had been obtained from three different makers, were found to contain the following weights of freshly distilled water when filled to the 50 cubic centimetre mark at 25° C.:—

1	49.9885	grammes.
2	49.9850	"
3	49.8500	"
4	49.8585	"
5	50.2200	"

The mean weight being 49.9804 grammes which represents 50.2149 cubic centimetres instead of 50. A sample of sugar actually polarizing 96.00° (the standard at present adopted for V. P. 544 refining crystals) if dissolved in 50.2149 cubic centimetres instead of 50 would give a reading of only 95.59°, thus showing an error of —0.41°. An actual determination made with a flask holding up to the mark 50.1375 grammes of water, with a sugar really polarizing 99.50°, gave a reading of only 98.80°, the error thus experimentally determined being —0.70° as against the calculated one of —0.74°. As refining crystals for the American market are required to polarize not less than the standard, and a reading even 0.10° below may cause the rejection of a parcel of sugar by an intending buyer, it is evident that the careful testing of the sugar flasks is by no means superfluous labour.

On account of the frequent breakage of the glass tubes used to contain the sugar solution for the polariscope, brass ones have been substituted at the laboratory, and are greatly to be recommended. Although the linear expansion by heat is nearly twice that of glass, yet the influence on the tubes of differences of climatic temperature is too small to appreciably affect the polarization. Thus a brass tube of exactly the right length, namely, 200 millimetres, at the standard temperature of 17.5° C., on being brought to this colony with a prevailing daily temperature of about 28° C. would only increase in length 0.04 millimetre and would consequently raise the readings only + 0.02°. In the case of glass the error would be about + 0.01°.

8. A good deal of time has been spent in ascertaining the best means of analysing molasses, the subject being a rather troublesome one, and very inadequately treated of in books. When solutions of crystallisable sugar or *sucrose* are treated with acids, the sucrose becomes converted into *glucose* or "invert sugar." The invert-sugar produced really consists of a mixture of two kinds of glucose, called respectively levulose and dextrose from their action on polarized light, but, as the rotatory power of the levulose predominates, the invert-sugar polarises to the left. A solution of sucrose polarizing 100 divisions to the right causes after heating with acids a deviation of 44 divisions to the left at a temperature of 0° C. The lævo-rotation of the invert-sugar regularly diminishes with increase of temperature

in the proportion of half a division for each degree centigrade. At the temperature of this colony the deviation is about 30 divisions. When solutions of sucrose containing invert-sugar are submitted to polarization, the reading obtained is the difference between the dextro-rotation of the one and the lævo-rotation of the other, and therefore only forms a correct guide to the amount of sucrose, when the amount of invert-sugar is known and its influence allowed for. At the temperature of this colony invert-sugar masks or conceals 28/100 of its weight of sucrose; in England about 34/100.

Molasses contains not only sucrose, but a considerable proportion of glucose, and the doubtful point is whether the glucose does or does not affect polarised light like invert-sugar. Certain sugar analysts say yes, and correct their polarimetric readings ac-
545 cordingly, others, on the contrary, declare that the glucose found in cane products differs from invert-sugar in having no rotatory power whatever and therefore that no correction is necessary.*

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* The following extract from Tucker's *Manual of Sugar Analysis*, 2 edit. 1883, p. 173, will show the present unsatisfactory condition of the subject:—"All raw sugar and molasses from the cane contain invert-sugar, sometimes in large amounts. Inasmuch as the rotatory power of invert-sugar made by acting upon cane-sugar with acids is strongly to the left, a mixture of the two will give in the saccharimeter a reading too low as expressing the cane sugar. It has been considered that the invert-sugar in the products of the cane possesses the same rotatory power as that artificially prepared, and it was customary with some chemists to correct their polariscopic readings by adding to them $\frac{34}{100}$ of the invert-sugar as found by the estimation with copper liquor.

Recent researches of Girard and Laborde tend to verify a previous observation of Dubrunfant—that the invert-sugar in cane products *is optically inactive*, and hence the use of the co-efficient $\frac{34}{100}$ involves an error. The results of the above chemists are based on the examination of (1) syrups artificially prepared from raw cane sugars of many sources; (2) of molasses from sugar plantations; and (3) from the refiner's molasses. The cane-sugar was estimated directly with the polariscope, and also very carefully by inversion and gravimetric determination with copper liquor. The invert-sugar was determined in the same manner. In the majority of the samples examined the percentage of sugar by the copper method agree quite closely with that by direct polarization, the latter being as often above as the former. Other investigators among whom may be mentioned Muntz, Morin, Gill and Halse, have confirmed the conclusions of the French chemists by an extended series of experiments upon raw sugar of all origins, cane-juice, molasses, &c. Morin shows that analysis of raw sugar corrected by the co-efficient $\frac{34}{100}$ generally add up to over 100, even when large amounts of undetermined organic matters are present. As beet sugars and syrups rarely contain more than traces of invert-sugar, these results have no special application in that direction.

Meissl has recently, by a most elaborate investigation gone over the ground covered by the authorities named, with the result of completely contradicting both their facts and their conclusions.

Working with seven low-grade raw sugars, from the cane, carrying from 5 to 13 per cent. invert-sugar, and determining the cane sugar after inversion, and the invert-sugar directly by Soxhlet's improved manipulation with Fehling's solution, he finds the cane-sugar by inversion to be always considerably higher than the saccharimetric reading, the difference varying with the amount of invert-sugar present, that by the use of the co-efficient $\frac{34}{100}$ the corrected percentage of sugar agrees closely with that by inversion; that the syrups extracted from these sugars by alcohol, and containing from 27 to 39 per cent. invert-sugar, give essentially the same results as above. He also proves that the sugars, on complete analysis, do not add up to over 100, but the quantity of organic matter not sugar, varies from 1 to 8 per cent. Meissl considers the conclusion of the chemists cited, as to the optical inactivity of invert-sugar in commercial products, as erroneous, and ascribes the error to the use of the gravimetric — met with — Fehling's so ution, which he claims gives results that are too high.

The glucose in molasses originates in two ways—(*i*) by the accumulation of that originally present in the juice and (*ii*) by the conversion (perhaps inversion) of sucrose during the manufacture of juice into sugar. The reporter has therefore made two series of very careful experiments, one on the glucose naturally present or produced in the cane, the other on the glucose in several kinds of molasses.

The quantity of glucose in the juice of fresh and mature canes is so small that its effects upon polarized light are inappreciable. But on keeping cane for some weeks after being cut, the glucose augments at the expense of the sucrose, until finally little else but
546 glucose can be found in the juice. Also in the tops of immature canes, glucose is present in large proportion relative to the sucrose sometimes more than equalling it in quantity. The amount of sucrose in the juice of cane in both conditions was carefully determined—1st, by the polariscope; 2nd, after inversion, by Soxhlet's volumetric method. The glucose was also determined. The following results repreesnt parts by weight in 100 of juice by measure:—

	Sucrose by polarization.	Sucrose by analysis.	Glucose.	Sucrose +28/100 glucose.
I. Stale mature cane juice.....	1·44	1·34	20·41	7·15
II. Stale mature cane juice.....	0·80	1·02	18·50	6·20
III. Fresh immature cane juice.....	5·37	5·53	5·67	6·96
IV. Fresh immature cane juice.....	1·38	1·73	3·89	2·47

These experments, which the reporter believes are entirely novel, fairly prove that the natural glucose in cane has practically no action on polarised light, and is therefore different from invert-sugar artificially prepared. The amount of sucrose shown by analysis agrees fairly well with that indicated by direct polarization, so that the glucose, although present in some cases in quantities enormously exceeding the sucrose, exercises practically no effect on the polarization. The column headed "Sucrose + 28/100 glucose" shows the amount of sucrose that would be indicated by applying the ordinary correction for invert sugar, at the temperature of 28° C.

A similar series of experiments with the ordinary kinds of molasses gave results as follows:—

100 parts by weight contained.

	Sucrose by polarization.	Sucrose by analysis.	Glucose.	Sucrose +28/100 glucose.
I. C. P. molasses (?)	40·15	40·31	16·98	44·90
II. 1st V. P. molasses	33·40	36·97	18·30	38·12
III. 2nd V. P. molasses	35·61	38·74	17·71	40·59
IV. Bloomer molasses	40·15	43·11	25·00	47·15
V. Bloomer molasses	44·00	46·08	21·23	49·94
VI. 2nd V. P. & triple effe t	0·00	0·77	45·05	7·22

In the first sample the glucose was inactive—the origin of this sample could not be ascertained, but it appeared to be common process molasses. In the remaining samples, the glucose exercised some left-handed rotation, but in no instance was the effect equal to
547 that produced by invert-sugar as indicated in the last column.

A striking instance is furnished by sample VI, the saccharine portion of which consisted almost wholly of glucose. Had this been invert sugar, it would have caused a lævo-deviation in the polariscope of —11.84 divisions of the scale,* whereas the reading was only $\frac{39.66}{45.05}$ —1.54. In this case therefore no less than —— of the glucose or 88.1 per cent. was inactive on polarised light. These experiments show that the glucose in molasses is too variable in its action to allow of any fixed correction being applied.

The method of determining sucrose in molasses now adopted at the Government laboratory is, shortly, as follows:

20 grammes of molasses are weighed out and dissolved in water to exactly half a litre. In this solution the glucose is determined by Soxhlet's volumetric method. 100 cubic centimetres of the same solution are then poured into a convenient flask with 5 cubic centimetres of strong pure hydrochloric acid, and the mixture heated to boiling, over a naked flame. The boiling is continued for about one minute, and then the contents of the flask are cooled under a tap of running water.† The acid present is partly neutralized by sodium hydrate solution, and finally by sodium carbonate in powder.

The neutralized solution is made up to half a litre, and the glucose, representing the total sugar, also determined by Soxhlet's process. Deducting the glucose originally present from that representing the total sugar, the remainder multiplied by .95 equals the sucrose.

The graduated glass instruments used are always the same, and consist of two 500 cubic centimetre (or ½ litre) flasks for making the solutions, and one 100 cubic centimetre burette, with glass stop-

*—12·61 if *no* sucrose had been present.

†Special experiments have been made to prove that this treatment causes complete conversion of sucrose into glucose.

cock for measuring the molasses solution for the copper test and for boiling with acid. Each of the flasks was graduated to hold exactly five times the volume of the burette. Lastly, a 25 c. c. pipette is used to measure out the copper test. The amount of glucose equivalent to the volume of solution delivered by this pipette is always accurately determined for the copper solution employed. The copper test is made from two solutions:

No. 1, consisting of 69.278 grammes of copper sulphate dissolved in water to a litre.

No. 2, consisting of 346 grammes Rochelle salt and 80 grammes caustic soda sticks, dissolved separately in water and made up to a litre.

These solutions are mixed for use in exactly equal proportions but are preserved apart; errors arising from the deterioration of the copper test are thus avoided.

In using the copper test, 25 cubic centimetres are measured
548 into a porcelain basin, and a quantity of the liquid to be tested sufficient to nearly reduce the copper liquor run in cold from the burette, sufficient water being also added to make up the whole to 50 cubic centimetres. The mixture is then boiled for two minutes, the precipitate allowed a moment or two to settle, and the supernatant liquid filtered.

If the filtrate has a blue colour or gives a chocolate precipitate when tested with excess of acetic acid and ferrocyanide of potassium solution, sufficient of the sugar liquid has not been added and the experiment must be repeated, using more sugar solution each time, until only a bare trace of copper can be detected in the filtrate by the ferrocyanide. When this point is reached, the quantity of sugar solution used contains an amount of glucose equal to the 25 c. c. of copper test (nominally .125 grammes), and a simple calculation shows the *the* total amount of glucose in the whole solution, and in the molasses from which it was prepared.

Very convenient porcelain basins called "casasroles" are employed for boiling the copper test; they hold about 6 fluid ounces, and are furnished with porcelain handles. To support them over the lamp, a hole is made in a square of asbestos cardboard sufficiently large to allow the bottom of the basin to pass through, the asbestos being placed on the earthenware screen that surrounds the lamp effectually prevents the flame from playing on the sides of the basin above the contents, and the consequent accidental reduction of the copper liquor.

For determining the value of the copper solution, used in preparing the copper-test, a very simple and rapid method was devised at the government laboratory. 25 cubic centimetres of the copper solution No. 1 are measured into a platinum basin, acidified with 1 cubic centimetre of strong sulphuric acid, and then a foot or two of magnesium ribbon are coiled up and placed in the basin, which is then quickly covered with a glass plate. In a very few minutes the whole of the copper is precipitated in the metallic state while the magnesium is wholly dissolved.

The liquid is poured off from the precipitated copper, which is

then washed by filling up the basin with water, and then carefully decanting it off; this is repeated several times. The washing is completed by adding in place of the water, firstly, strong alcohol, and lastly, ether. After draining, the basin is placed in the hot air oven for a few minutes to dry, and then weighed. The weight of copper found multiplied by .5678 gives the amount of glucose that will reduce 25 cubic centimetres of the copper solution. The novelty of this process is in the use of metallic magnesium to precipitate the copper. Metallic zinc has long been used for determining copper in general, but it has drawbacks from which magnesium is quite free. The whole operation with magnesium can be performed in half an hour. Many experiments have been made with this simple method and have proved that the results obtained are almost perfect.

E. E. H. FRANCIS,
Government Analytical Chemist.

549 EXHIBIT C, SUIT 2918.

Certificates of Polarization, Government Laboratory, Georgetown, Demerara.

No. 1.

Certificate of polarization

Of one sample of refining sugar received on the 13th of November, 1882, from Messrs. S. Barber & Company.

Mark.	Polarization.	Colour, D. S.
Annandale	92.1 + .3 = 92.4	

No. 2.

Certificate of polarization

Of 3 samples of refining sugar received on the 14th of November, 1882, from Messrs. S. Barber & Company.

Mark.	Polarization.	Colour, D. S.
Annandale	93.4 + .3 = 93.90°	
Springhall	94.4 + .3 = 94.70°	
Laboune Intention	94.5 + .3 = 94.80°	

No. 3.

Certificate of polarization

Of 1 sample of refining sugar received on the 15th of November, 1882, from Messrs. Booker Brothers & Company.

Mark.	Polarization.	Colour, D. S.
W R	94.9 + .3 95.2	

No. 4.

Certificate of polarization

Of one sample of refining sugar received on the 16th of November, 1882, from Messrs. S. Barber & Company.

Mark.	Polarization.	Colour, D. S.
No mark	85.4 + .3 = 85.7	

No. 5.

Certificate of polarization

Of 1 sample of V. P. sugar received on the 20th of November, 1882, from H. Sproston, Esquire.

Mark.	Polarization.	Colour, D. S.
D. E. K.	92.3 + .3 = 92.60°	

550

No. 6.

Certificate of polarization

Of two samples of refining sugar received on the 24th of November, 1882, from the Colonial Company, Limited.

Mark.	Polarization.	Colour, D. S.
A	93.1 + .3 93.4	
B	93.1 + .3 = 93.4	

No. 7.

Certificate of polarization

Of one sample of refining sugar received on the 25th of November, 1882, from Messrs. Booker Brothers & Company.

Mark.	Polarization.	Colour, D. S.
T	91.6. + 3 =91.9°	

No. 8.

Certificate of polarization

Of a sample of refining sugar received on the 30th of November, 1882, from Messrs. S. Barber & Company.

Mark.	Polarization.	Colour, D. S.
Herotilling	76.6. + 3 = 76.9	

No. 9.

Certificate of polarization

Of four samples of refining sugar received on the 30th of November, 1882, from Messrs. A. W. Perot & Company.

Mark.	Polarization.	Colour, D. S.
A	93.5 + .3 = 93.8	
B	92.6 + .3 = 92.90	
C	94.2 + .3 = 94.50	
D	94.3 + .3 = 94.60	

No. 10.

Certificate of polarization

Of four samples of refining sugar received on the 2d of December, 1882, from Messrs. A. W. Perot & Company.

Mark.	Polarization.	Colour, D. S.
B. bags	95.2 + .3 = 95.50	
RX hhds.	95.3 + .3 = 95.60°	
F bags	96.3 + .3 = 96.60	

551

No. 11.

Certificate of polarization

Of one sample of refining sugar received on the 2d of December, 1882, from Messrs. A. W. Perot and Company.

Mark.	Polarization.	Colour, D. S.
GD hhds.	95.1 + .3 = 95.40°	

No. 12.

Certificate of polarization

Of one sample of refining sugar received on the 2d of December, 1882, from Edwin McLeod, Esquire.

Mark.	Polarization.	Colour, D. S.
AR 340	92.4 + .3 = 92.70	

No. 13.

Certificate of polarization

Of one sample of refining sugar received on the 4th of December, 1882, from the Colonial Company, Limited.

Mark.	Polarization.	Colour, D. S.
C.	94.0 + .3 = 94.30	

No. 14.

Certificate of polarization

Of one sample of refining sugar received on the 4th of December, 1882, from Messrs. Booker Brothers & Company.

Mark.	Polarization.	Colour, D. S.
R	93.2 + .3 = 93.50°	

No. 15.

Certificate of polarization

Of one sample of refining sugar received on the 5th of December, 1882, from Edwin McLeod, Esquire.

Mark.	Polarization.	Colour, D. S.
A R-400, 389, 405, 410, 374, 398, 376, 379, 381, 391.	92.9 + .3 = 93.20	

552

No. 16.

Certificate of polarization

Of one sample of refining sugar received on the 7th of December, 1882, from W. Bagot, Esquire.

Mark.	Polarization.	Colour, D. S.
A S	94.8 + .3 = 95.1°	

No. 17.

Certificate of polarization

Of one sample of refining sugar received on the 7th of December, 1882, from Messrs. Davson Bros. & Company.

Mark.	Polarization.	Colour, D. S.
Belle Plaine	94.6 + .3 = 94.9	

No. 18.

Certificate of polarization

Of one sample of refining sugar received on the 9th of December, 1882, from Messrs. Booker Brothers & Company.

Mark.	Polarization.	Colour, D. S.
S	93.7 + .3 = 94°	

No. 19.

Certificate of polarization

Of two samples of refining sugar received on the 9th of December, 1882, from Messrs. Davson Brothers & Company.

Mark.	Polarization.	Colour, D. S.
Belle Plaine No. 1	94.3 + .3 = 94.6	
" " No. 2	94.4 + .3 = 94.7	

No. 20.

Certificate of polarization

On one sample of refining sugar received on the 11th of December, 1882, from Messrs. Booker Brothers & Company.

Mark.	Polarization.	Colour, D. S.
R	93.7 + .3 = 94.0°	

553

No. 21.

Certificate of polarization

Of one sample of refining sugar received on the 11th of December, 1882, from the Colonial Company, Limited.

Mark.	Polarization.	Colour, D. S.
D	93.9 + .3 = 94.20	

No. 22.

Certificate of polarization

Of three samples of refining sugar received on the 20th of December, 1882, from E. McLeod, Esquire.

Mark.	Polarization.	Colour, D. S.
VS D	96.0 + .3 = 96.30	
M G	95.1 + .3 = 95.4	
H D C	95.8 + .3 = 96.1	

No. 23.

Certificate of polarization

Of one sample of refining sugar received on the 21st of December, 1882, from Edwin McLeod, Esquire.

Mark.	Polarization.	Colour, D. S.
C & T	94.3 + .3 = 94.60	

No. 24.

Certificate of polarization

Of one sample of refining sugar received on the 23d of December, 1882, from the Colonial Company, Limited.

Mark.	Polarization.	Colour, D. S.
A	93.80 + .3 = 94.10	

No. 25.

Certificate of polarization

Of two samples of refining sugar received on the 28th of December, 1882, from Edwin McLeod, Esquire.

Mark.	Polarization.	Colour, D. S.
A. N.	94.0 + .3 = 94.30°	
P U	25.7 + .3 = 96.00°	

554

No. 26.

Certificate of polarization

Of 2 samples of refining sugar received on the 4th of January, 1883, from Messrs. Booker Bros. & Co.

Mark.	Polarization.	Colour, D. S.
B No. 1	92.7 + .3 = 93.0	
B No. 2	92.4 + .3 = 92.7	

No. 27.

Certificate of polarization

Of one sample of refining sugar received on the 8th of January, 1883, from Messrs. S. Barber & Co.

Mark.	Polarization.	Colour, D. S.
a/c (?)	94.8 = 95.10	

No. 28.

Certificate of polarization

Of one sample of refining sugar received on the 9th of January, 1883, from Edwin McLeod, Esquire.

Mark.	Polarization.	Colour, D. S.
P. G.	94.3 + .3 = 94.60	

No. 29.

Certificate of polarization

Of one sample of refining sugar received on the 12th of January, 1883, from Edwin McLeod, Esquire.

Mark.	Polarization.	Colour, D. S.
A.	95. + .3 = 95.3	
L. C. M.		
81		

No. 30.

Certificate of polarization

Of one sample of refining sugar received on the 16th of January, 1883, from Edwin McLeod, Esquire.

Mark.	Polarization.	Colour, D. S.
P U	92.1 + .3 = 92.40	

555

No. 31.

Certificate of polarization

Of one sample of refining sugar received on the 16th of January, 1883, from Edwin McLeod, Esquire.

Mark.	Polarization.	Colour, D. S.
P U	95.0 + .3 = 95.30°	

No. 32.

Certificate of polarization

Of two samples of refining sugar received on the 18th of January, 1883, from Messrs. S. Barber & Company.

Mark.	Polarization.	Colour, D. S.
Stewardville	92.3 + .3 = 92.6	
Perseverance	95.1 + .3 = 95.4	

No. 33.

Certificate of polarization

Of one sample of refining sugar received on the 24th of January, 1883, from Messrs. S. Barber & Company.

Mark.	Polarization.	Colour, D. S.
Camfield	94.1 + .3 = 94.4	

No. 34.

Certificate of polarization

Of two samples of refining sugar received on the 24th of January, 1883, from Edwin McLeod.

Mark.	Polarization.	Colour, D. S.
AN 1311	94.1 + .3 = 94.4	
HC D	96.0 + .3 = 96.30	

No. 35.

Certificate of polarization

Of one sample of refining sugar received on the 24th of January, 1883, from Messrs. Booker Brothers & Company.

Mark.	Polarization.	Colour, D. S.
M	92.8 + .3 = 93.10	

556

No. 36.

Certificate of polarization

Of one sample of refining sugar received on the 30th of January, 1883, from Messrs. S. Barber & Co.

Mark.	Polarization.	Colour, D. S.
Perseverance	94.9 + .3 = 95.20	

No. 37.

Certificate of polarization

Of a sample of refining sugar received on the 30th of January, 1883, from Messrs. George Little & Company.

Mark.	Polarization.	Colour, D. S.
C G. 112 bags sugar, 10 samples, Nos. 435, 485, 524, 504, 508, 526, 549, 518, 446, 585.	96.0 + .3 = 96.3	

No. 38.

Certificate of polarization

Of a sample of refining sugar received on the 30th of January, 1883, from Messrs. George Little & Company.

Mark.	Polarization.	Colour, D. S.
G. & B., 40 bags of sugar, 10 samples, Nos. 349, 402, 459, 449, 357, 389, 460, 561, 350, 355.	93.4 + .3 = .93.70	

No. 39.

Certificate of polarization

Of a sample of refining sugar received on the 30th of January, 1883, from Messrs. George Little & Company.

Mark.	Polarization.	Colour, D. S.
A R 139 bags. 10 samples, Nos. 5508, 5491, 5485, 5500, 5542, 5490, 5462, 5416, 5483, 5472.	95.8 + .3 = 96.1	

557

No. 40.

Certificate of polarization

Of the sample of refining sugar received on the 31st of January, 1883, from Messrs. Booker Brothers & Company.

Mark.	Polarization.	Colour, D. S.
F. E. & Co.	95.6 + .3 = 95.9.	

No. 41.

Certificate of polarization

Of a sample of refining sugar received on the 1st of February 1883, from Messrs. George Little & Company.

Mark.	Polarization.	Colour, D. S.
E 40 hhd. H Nos. 99/138	94.0 + .3 = 94.3	

No. 42.

Certificate of polarization

Of a sample of refining sugar received on the 1st of February, 1883, from Messrs. Geo. Little & Company.

Mark.	Polarization.	Colour, D. S.
A R 33 hhds. Nos. 866/898	95.3 + .3 = 95.60	

No. 43.

Certificate of polarization

Of a sample of refining sugar received on the 2d of February, 1883, from Messrs. S. Barber & Company.

Mark.	Polarization.	Colour, D. S.
La Buene Intention.	93.6 + .3	93.9

No. 44.

Certificate of polarization

Of two samples of refining sugar received on the 2d of February, 1883 from Messrs. S. Barber & Company.

Mark.	Polarization.	Colour, D. S.
L. B. I. No. 1.	93.5 + .3 = 93.8	
L. B. I. No. 2.	94.3 + .3 = 94.6	

558

No. 45.

Certificate of polarization

Of a sample of refining sugar received on the 3rd of February, 1883, from Messrs. Geo. Little & Company.

Mark.	Polarization.	Colour, D. S.
B. A. 12 hhds. Nos. 1/12	93.6 + .3 = 93.9	

No. 46.

Certificate of polarization

Of a sample of refining sugar received on the 3d of February, 1883, from Messrs. Geo. Little & Company.

Mark.	Polarization.	Colour, D. S.
E 280 bags sugar, P 20 samples, Nos. 234, 248, 184, 242, 267, 240, 218, 195, 193, 233, 390, 338, 314, 395, 361, 283, 365, 281, 337, 335.	93.4 + .3 = 93.70.	

No. 47.

Certificate of polarization

Of one sample of refining sugar received on the 5th of February, 1883, from Messrs. S. Barber & Company.

Mark.	Polarization.	Colour, D. S.
"Belle Vire"	94.0 + .3 = 94.3	

No. 48.

Certificate of polarization

Of a sample of refining sugar received on the 6th of February, 1883, from Messrs. Geo. Little & Company.

Mark.	Polarization.	Colour, D. S.
E 20 hhds. P D. C. sugar, Nos. 139/158.	94.8 + .3 = 95.1.	

559

No. 49.

Certificate of polarization.

Of a sample of refining sugar received on the 8th of February, 1883, from Wm. Smith, Esquire.

Mark.	Polarization.	Colour, D. S.
No mark.	93.8 + .3 = 94.1	

No. 50.

Certificate of polarization

Of a sample of refining sugar received on the 10th of February, 1883, from W. Bagot, Esquire.

Mark.	Polarization.	Colour, D. S.
W. B. No. 1.	95.0 + .3 = 95.3	

No. 51.

Certificate of polarization

Of a sample of refining sugar received on the 10th of February, 1883, from Messrs. S. Barber & Company.

Mark.	Polarization.	Colour, D. S.
R. A.	90.0 + .3 = 90.30°	

No 52.

Certificate of polarization

Of a sample of refining sugar received on the 13th of February, 1883, from Messrs. S. Barber & Co.

Mark.	Polarization.	Colour, D. S.
Canefield	95.0 + .3 = 95.3	

No. 53.

Certificate of polarization

Of a sample of refining sugar received on the 14th of February, 1883, from W. Bagot, Esquire.

Mark.	Polarization.	Colour, D. S.
W. B.	94.9 + .3 = 95.2.	

560

No. 54.

Certificate of polarization

Of five samples of refining sugar received on the 16th of February, 1883, from A. Barr, Esquire.

Mark.	Polarization.	Colour, D. S.
A	93.9 + .3 = 94.2	
B	93.2 + .3 = 93.5	
C	93.2 + .3 = 93.5	
D	93.5 + .3 = 93.8	
E	93.9 + .3 = 94.20	

No. 55.

Certificate of polarization

Of two samples of refining sugar received on the 17th of February, 1883, from Messrs. Booker Brothers & Company.

Mark.	Polarization.	Colour, D. S.
S. No. 1. Hhds.	93.8 + .3 = 94.1	
S. No. 2. Bags.	93.0 + .3 = 93.3	

No. 56.

Certificate of polarization

Of a sample of refining sugar received on the 19th of February, 1883, from S. Barber & Co.

Mark.	Polarization.	Colour, D. S.
S WR Bags.	92.7 + .3 = 93.0	

No. 57.

Certificate of polarization

Of a sample of refining sugar received on the 19th of February, 1883, from Messrs. Ramsney, Hill & Company.

Mark.	Polarization.	Colour, D. S.
No. 1.	95.5 + .3 = 95.80°	

No. 58.

Certificate of polarization

Of a sample of refining sugar received on the 19th of February, 1883, from Messrs. S. Barber & Company.

Mark.	Polarization.	Colour, D. S.
S. W. R. Hhds.	93.5 + .3 = 93.8	

561

No. 59.

Certificate of polarization

Of a sample of refining sugar received on the 20th of February, 1883, from Messrs. Ramsay, Hill & Company.

Mark.	Polarization.	Colour, D. S.
No. mark	95.5 + .3 = 95.80	

No. 60.

Certificate of polarization

Of a sample of refining sugar received on the 20th of February, 1883, from Messrs. Geo. Little & Company.

Mark.	Polarization.	Colour, D. S.
[O.] D. 540 bags 30 samples	95.5 + .3 = 95.80°	

No. 61.

Certificate of polarization

Of a sample of refining sugar received on the 21st of February, 1883, from Messrs. S. Barber & Co.

Mark.	Polarization.	Colour, D. S.
R. H.	93.4 + .3 = 93.70	

No. 62.

Certificate of polarization

Of a sample of refining sugar received on the 22nd of February, 1883, from Messrs. Ramsay, Hill & Company.

Mark.	Polarization.	Colour, D. S.
De K.	95.8 + .3 = 96.10°	

No. 63.

Certificate of polarization

Of two samples of refining sugar received on the 22nd of February, 1883, from Messrs. S. Barber & Company.

Mark.	Polarization.	Colour, D. S.
Annandale #1	91.30 + .3 = 91.60°	
Annandale No. 2	86.50 + .3 = 86.80°	

562

No. 64.

Certificate of polarization

Of a sample of refining sugar received on the 24th of February, 1883, from W. Bagot, Esquire.

Mark.	Polarization.	Colour, D. S.
A	94.5 + .3 = 94.80°	

No. 65.

Certificate of polarization

Of a sample of refining sugar received on the 24th of February, 1883, from Messrs. S. Barber & Co.

Mark.	Polarization.	Colour, D. S.
Rose Hall.	93.0 + .3 = 93.30	

No. 66.

Certificate of polarization

Of two samples of refining sugar received on the 26th of February, 1883, from Messrs. S. Barber & Co.

Mark.	Polarization.	Colour, D. S.
Hampton Court.	94.9 + .3 = 95.20	
Camfield.	95.2 + .3 = 95.50	

No. 67.

Certificate of polarization

Of a sample of refining sugar received on the 28th of February, 1883, from Messrs. S. Barber & Co.

Mark.	Polarization.	Colour, D. S.
Rose Hall.	92.5 + .3 = 92.80	

No. 68.

Certificate of polarization

Of a sample of refining sugar received on the 28th of February, 1883, from Messrs. Booker Brothers & Co.

Mark.	Polarization.	Colour, D. S.
B. B.	93.3 + .3 = 93.60°	

563

No. 69.

Certificate of polarization

Of a sample of refining sugar received on the 28th of February, 1883, from Messrs. S. Barber & Company.

Mark.	Polarization.	Colour, D. S.
"Skeldon"	93.2 + .3 = 93.50	

No. 70.

Certificate of polarization

Of a sample of refining sugar received on the 1st of March, 1883, from Messrs. S. Barber & Co.

Mark.	Polarization.	Colour, D. S.
S W R Hhds.	93.0 + .3 = 93.30°	

No. 71.

Certificate of polarization

Of a sample of refining sugar received on the 2d of March, 1883, from W. Bagot, Esquire.

Mark.	Polarization.	Colour, D. S.
[P]	96. + .3 = 96.30	

No. 72.

Certificate of polarization

Of a sample of refining sugar received on the 3d of March, 1883, from Messrs. S. Barber & Co.

Mark.	Polarization.	Colour, D. S.
A M	87.5 + .3 = 87.80	

No. 73.

Certificate of polarization

Of a sample of refining sugar received on the 5th of March, 1883, from Messrs. Geo. Little & Co.

Mark.	Polarization.	Colour, D. S.
[A]e 10 Hhds	95.5° + .3 = 95.80	

564

No. 74.

Certificate of polarization

Of a sample of refining sugar received on the 5th of March, 1883, from Messrs. Geo. Little & Co.

Mark.	Polarization.	Colour, D. S.
[c]D 10 samples	96.4 + 4.3 = 96.70	

No. 75.

Certificate of polarization

Of a sample of refining sugar received on the 6th of March, 1883, from Messrs. Geo. Little & Co.

Mark.	Polarization.	Colour, D. S.
G W 24 Hhds. N 1/24	95.0 + .3 = 95.30	

No. 76.

Certificate of polarization

Of a sample of refining sugar received on the 6th of March, 1883, from Messrs. Geo. Little & Co.

Mark.	Polarization.	Colour, D. S
[H] 30 samples.	94.70 + .3 = 95.00°	

No. 77.

Certificate of polarization

Of a sample of refining sugar received on the 7th of March, 1883, from Messrs. Geo. Little & Co.

Mark.	Polarization.	Colour, D. S.
[O] 12 hhds.	93.0 + .3 = 93.30	

No. 78.

Certificate of polarization

Of a sample of sugar received on the 28th of March, 188–, from S. B. & Co.

Mark.	Polarization.	Colour, D. S.
Houston.		

565 No. 79.

Certificate of polarization

Of one sample of sugar received on the 28th of March, 188–, from W. Bagot.

Mark.	Polarization.	Colour, D. S.
S V.		

No. 80.

Certificate of polarization

Of one sample of dark sugar received on the 18th of April, 1883, from Messrs. S. Barber & Co.

Mark.	Polarization.	Colour, D. S.
GVVV.	942.	

No. 81.

Certificate of polarization

Of one sample of dark sugar received on the 19th of April, 1883, from Messrs. S. Barber & Co.

Mark.	Polarization.	Colour, D. S.
GVVV.	93.	

No. 82.

Certificate of polarization

Of a sample of refining sugar received on the 8th of May, 1883, from Messrs. S. Barber — Co.

Mark.	Polarization.	Colour, D. S.
[P] Bags.	95 + .3 = 95.30.	

No. 83.

Certificate of polarization

Of a sample of refining sugar received on the 16th of May, 1883, from Messrs. S. Barber & Company.

Mark.	Polarization.	Colour, D. S.
P. Q.	88.7 + .3 = 89.0.	

566

No. 84.

Certificate of polarization

Of a sample of refining sugar received on the 19th of May, 1883, from Messrs. S. Barber & Co.

Mark.	Polarization.	Colour, D. S.
[VS]	94 + .5.3.	

No. 85.

Certificate of polarization

Of two samples of refining sugar received on the 22d of May, 1883, from Messrs. S. Barber & Company.

Mark.	Polarization.	Colour, D. S.
[VS] 525 to 536	95.4 + .3 = 95.70°	
[VS] 597 to 608	94.3 + .3 = 94.60°	

No. 86.

Certificate of polarization

Of one sample of refining sugar received on the 23d of May, 1883, from Messrs. S. Barber & Company.

Mark.	Polarization.	Colour, D. S.
[B]	93.4 + .3 = 93.70.	

No. 87.

Certificate of polarization

Of one sample of refining sugar received on the 25th of May, 1883, from Messrs. S. Barber & Company.

Mark.	Polarization.	Colour, D. S.
AN 40 Hhds.	95.1 + .3 95.4.	

No. 88.

Certificate of polarization

Of one sample of refining sugar received on the 26th of May, 1883, from Messrs. S. Barber & Company.

Mark.	Polarization.	Colour, D. S.
AN 23 hhds.	95.3 + .3 95.60°.	

567

No. 89.

Certificate of polarization

Of one sample of refining sugar received on the 2d of June, 1883, from Messrs. S. Barber & Co.

Mark.	Polarization.	Colour, D. S.
[B]	93.7 + .3 = 94.0°.	

No. 90.

Certificate of polarization

Of 3 samples of refining sugar received on the 4th of June, 1883, from Messrs. S. Barber & Co.

Mark.	Polarization.	Colour, D. S.
No. 1 [LBM]	83.3 + .3 = 83.6.	
A [P] D	80.7 + .3 = 81.	
L [H] C	84.0 + .3 = 84.3.	

No. 91.

Certificate of polarization

Of one sample of refining sugar received on the 6th of June, 1883, from Messrs. J. E. Perot & Co.

Mark.	Polarization.	Colour, D. S.
1	93.4 + .3 = 93.7	

No. 100.

Certificate of polarization

Of a sample of muscovado sugar received on the 7th of June, 1883, from Messrs. Booker Bros. & Company.

Mark.	Polarization.	Colour, D. S.
B. B.	83.2 + .3 = 83.5	

No. 101.

Certificate of polarization

Of a sample of refining sugar received on the 8th of June, 1883, from Messrs. S. Barber & Co.

Mark.	Polarization.	Colour, D. S.
[L]	86.0 + .3 = 86.3	

568

No. 102.

Certificate of polarization

Of one sample of refining sugar received on the 11th of June, 1883, from Messrs. George Little & Company.

For C. W.'s a/c.

Mark.	Polarization.	Colour, D. S.
E FP 140 bags 14 samples No. 2897, 2903, 2919, 2921, 2949, 2950, 2969, 2976, 2979, 2994, 3006, 3018, 3033, 3034,	96.1 + .3 = 96.40°	

No. 103.

Certificate of polarization

Of one sample of refining sugar received on the 13th of June, 1883, from Messrs. Booker Brothers & Company.

Mark.	Polarization.	Colour, D. S.
M	90. + .3 = 90.30	

No. 104.

Certificate of polarization

Of a sample of refining sugar received on the 15th of June, 1883, from (P. H. Nind, Esq.) Booker Bros. & Co.

Mark.	Polarization	Colour, D. S.
ME	89.40°	

No. 105.

Certificate of polarization

Of a sample of refining sugar received on the 16th of June, 1883, from A. W. Perot & Company.

Mark.	Polarization.	Colour, D. S.
[E] BH.	89.0 + .3 = 89.30	

569

No. 106.

Certificate of polarization

Of a sample of refining sugar received on the 16th of June, 1883, from Messrs. Booker Bros. & Co.

Mark.	Polarization.	Colour, D. S.
[M] E.	89.0 + .3 = 89.3°	

No. 107.

Certificate of polarization

Of one sample of refining sugar received on the 20th of June, 1883, from Messrs. G. Little & Co.

Mark.	Polarization.	Colour, D. S.
C. C. 162 bags 3329, 3268, 3322 3261, 3268, 3236 3169, 3242, 3280 3231, 3255, 3308 3304, 3212, 3325 3209	93.5 + .3 = 93.80°	

No. 108.

Certificate of polarization

Of one sample of refining sugar received on the 20th of June, 1883, from Messrs. G. Little & Co.

Mark.	Polarization.	Colour, D. S.
R. H. 33 hhds. No. 570/602	96.3 + .3 = 96.60°	

No. 109.

Certificate of polarization

Of one sample of refining sugar received on the 20th of June, 1883, from Messrs. G. Little & Co.

Mark.	Polarization.	Colour, D. S.
[C D] 180 bags	96.2 + .3 = 96.50	

570 No. 110

Certificate of polarization

Of one sample of refining sugar received on the 20th of June, 1883, from Messrs. G. Little & Co.

Mark.	Polarization.	Colour, D. S.
E H 12 hhds. Nos. 490/501	96.0 + .3 = 96.30	

No. 111.

Certificate of polarization

Of one sample of refining sugar received on the 20th of June, 1883, from Messrs. G. Little & Co.

Mark.	Polarization.	Colour, D. S.
C X J 24 hhds. Nos. 589/612	95.6 + .3 = 95.90	

No. 112.

Certificate of polarization

Of a sample of refining sugar received on the 21st of June, 1883, from Messrs. Geo. Little & Company.

Mark.	Polarization.	Colour, D. S.
CG 20 hhds. No. 280/299	93.9 + .3 = 94.20°	

No. 113.

Certificate of polarization

Of one sample of refining sugar received on the 21st of June, 1883, from Messrs. G. Little & Company.

Mark.	Polarization.	Colour, D. S.
E-H 10 hhds. out of 100	96.0 + .3 = 96.30°	

No. 114.

Certificate of polarization

Of one sample of refining sugar received on the 21st of June, 1883, from Messrs. Geo. Little & Co.

Mark.	Polarization.	Colour, D. S.
E-H 10 bags out of 100	95.9 + .3 = 96.2	

571

No. 115.

Certificate of polarization

Of one sample of refining sugar received on the 21st of June, 1883, from Messrs. G. Little & Co.

Mark.	Polarization.	Colour, D. S.
JJP 36 hhds No. 665, 669/678, 681/698, 700, 702, 704, 705, 707, 709, 710, 712, 780. June 22d.	95.9 + .3 = 96.20°	

G. Little & Co.

No. 116.

PG 130 bags. Polarization	95.8 + .3 = 96.10	

No. 117.

CG 20 hhds. Polarization. June 23.	94.4 + .3 = 94.70°	

Messrs. S. Barber & Co.

No. 118.

E ND	82.6 + .3 = 82.90°	

Messrs. Geo. Little & Co.

No. 119.

C. & J. 42 hhds.	No. 613/654 94.4 + .3 = 94.70°	

No. 120.

E 32 hhds.	No. 530/562 96.1 + .3 = 96.40°	

No. 121.

PC 130 bags	13 samples. 95.1 + .3 = 95.40	

June 25th.

G. Little & Co.

572 No. 122.

R. A. 55 trcs. 10 samples.
96.5 + .3 = 96.80°
June 27th.

Messrs. Boober Bros. & Co.

No. 123.

3 samples.
A 220 bags 92.0 + .3 = 92.30°
B 190 bags 92.0 + .3 = 92.3°
C 206 bags 91.8 + .3 = 92.10
June 27th.

Messrs. A. W. Perot.

No. 124.

Samples of sugar. 94.70° + .3 = 95.00°
June 27th.

Messrs. G. Little & Co.

No. 125.

[CF] 94.6 + .3 = 94.90°
June 29th.

Messrs. G. Little & Co.

No. 126.

2 samples.
[CD] 160 bags 16 samples.
95.4 + .3 = 95.7.
E
HP 42 hhds. 96.2 +.3 = 96.50%

EXHIBIT D, SUIT 2918.

Certificates of Polarization, Government Laboratory, Georgetown, Demerara.

127.

Certificate of polarization

Of one sample of dark sugar received on the 29th of June, 1883, from Messrs. G. Little & Co.

Mark.	Polarization.	Colour, D. S.
G x B 20 hhds.	94.2 + .3 = 94.5	

573

No. 129.

Certificate of polarization

Of one sample of refining sugar received on the 29th of June, 1883, from Messrs. Geo. Little & Co.

Mark.	Polarization.	Colour, D. S.
G x B 160 bags 16 samples	94.30 + .30 = 94.60	

No. 130.

Certificate of polarization

Of a sample of refining sugar received on the 29th of June, 1883, from Messrs. Geo. Little & Co.

Mark.	Polarization.	Colour, D. S.
E H 22 hhds	96.2 + .3 = 9650	

No. 131.

Certificate of polarization

Of one sample of refining sugar received on the *the* 30th of June, 1883, from Messrs. Geo. Little & Co.

Mark.	Polarization.	Colour, D. S.
J J V 54 hhds.	96.2 + .3 = 96.50°	

No. 132.

Certificate of polarization

Of one sample of refining sugar received on the 30th of June, 1883, from Messrs. Geo. Little & Co.

Mark.	Polarization.	Colour, D. S.
C. G. 162 bags.	95.2 + .3 = 95.50°	

No. 133.

Certificate of polarization

Of a sample of refining sugar received on the 30th of June, 1883, from Messrs. Booker Bros. & Co.

Mark.	Polarization.	Colour, D. S.
G	93.0 + .3 = 93.30°	

574

No. 134.

Certificate of polarization

Of one sample of refining sugar received on the 7th of July, 1883, from Messrs. A. W. Perot & Co.

Mark.	Polarization.	Colour, D. S.
None.	88.3 + .3 = 88.60	

No. 135.

Certificate of polarization

Of one sample of refining sugar received on the 9th of July, 1883, from Messrs. S. Barber & Co.

Mark.	Polarization.	Colour, D. S.
Experiment	94.2 + .3 = 94.50	

No. 136.

Certificate of polarization

Of one sample of refining sugar received on the 9th of July, 1883, from Messrs. George Little & Co.

Mark.	Polarization.	Colour, D. S.
BG 97 bags	93.30 + 3 = 93.60	

No. 137.

Certificate of polarization

Of one sample of refining sugar received on the 9th of July, 1883, from Messrs. Geo. Little & Co.

Mark.	Polarization.	Colour, D. S.
CXJ 8 hhds. Nos. 739/746	93.40 + .3 = 93.70	

No. 138.

Certificate of polarization

Of one sample of refining sugar received on the 10th of July, 1883, from Messrs. George Little & Co.

Mark.	Polarization.	Colour, D. S.
[Z] 179 bags 16 samples	95.70 + .3 = 96.00°	

575

No. 139.

Certificate of polarization

Of one sample of refining sugar received on the 10th of July, 1883, from Messrs. George Little & Co.

Mark.	Polarization.	Colour, D. S.
R H 5 tres 300 bags 32 samples	96.2 + .3 = 96.50.	

No. 140.

Certificate of polarization

Of one sample of refining sugar received on the 11th of July, 1883, from Messrs. George Little & Co.

Mark.	Polarization.	Colour, D. S.
[Z] 20 hhds No. 46/65	95.7 + .3 = 96.00	

No. 141.

Certificate of polarization

Of one sample of refining sugar received on the 11th of July, 1883, from Messrs. S. Barber & Co.

Mark.	Polarization.	Colour, D. S.
NP	87.2 + .3 = 87.50.	

No. 142.

Certificate of polarization

Of one sample of refining sugar received on the 11th of July, 1883, from E. McLeod, Esquire.

Mark.	Polarization.	Colour, D. S.
D.V.D. 821, 819, 826, 804, 805, 827, 823, 807, 816, 806.	95.3 + .3 = 95.60	

576

No. 143.

Certificate of polarization

Of one sample of refining sugar received on the 11th of July, 1883, from E. McLeod, Esq.

Mark.	Polarization.	Colour, D. S.
D.V.D. 786, 785, 800, 781, 788, 783, 773, 801, 794, 799.	94.2 + .3	94.50

No. 144.

Certificate of polarization

Of two samples of refining sugar received on the 13th of July, 1883, from Messrs. A. W. Perot & Co.

Mark.	Polarization.	Colour, D. S.
[C] centrifugal	72.7 + .3 = 73.00	
[HE] muscovado	83.6 + .3 = 83.90	

No. 145.

Certificate of polarization

Of one sample of refining sugar received on the 14th of July, 1883, from E. McLeod, Esquire.

Mark.	Polarization.	Colour, D. S.
[GD] 832, 837, 835, 828, 843, 847, 849, 851, 854, 855.	94.1 + .3 = 94.40	

No. 146.

Certificate of polarization

Of two samples of refining sugar received on the 16th of July, 1883, from Messrs. S. Barber & Co.

Mark.	Polarization.	Colour, D. S.
No. 1 [3]	94.9 + .3	95.20°
No. 2 [B]	95.2 + .3 = 95.50°	

577.

No. 147.

Certificate of polarization

Of one sample of refining sugar received on the 16th of July, 1883, from Messrs. A. W. Perot & Co.

Mark.	Polarization.	Colour, D. S.
GH.	95.2 + .3 = 95.50	

No. 148.

Certificate of polarization

Of one sample of refining sugar received on the 17th of July, 1883, from Messrs. G. Little & Co.

Mark.	Polarization.	Colour, D. S.
[Z] 18 bags	95.5 + .3 = 95.80	

No. 149.

Certificate of polarization

Of one sample of refining sugar received on the 17th of July, 1883, from Messrs. A. W. Perot & Co.

Mark.	Polarization.	Colour, D. S.
None.	94.3 + .3 = 94.60°	

No. 150.

Certificate of polarization

Of one sample of refining sugar received on the 18th of July, 1883, from Messrs. S. Barber & Co.

Mark.	Polarization.	Colour, D. S.
[B]	94.9 + .3 = 95.20°.	

No. 151.

Certificate of polarization

Of one sample of refining sugar received on the 18th of July, 1883, from Messrs. A. W. Perot & Co.

Mark.	Polarization.	Colour, D. S.
[H]	94.5 + .3 = 94.80	

578

No. 152.

Certificate of polarization

Of one sample of refining sugar received on the 18th of July, 1883, from Messrs. Sandbach, Parker & Co.

Mark.	Polarization.	Colour, D. S.
GV	97.3 + .3 = 97.60	

No. 153.

Certificate of polarization

Of one sample of refining sugar received on the 18th of July, 1883, from Messrs. A. W. Perot & Co.

Mark.	Polarization.	Colour, D. S.
GL 1	95.6 + .3 = 95.90°	
GL 2	94.4 + .3 = 94.70	

No. 154.

Certificate of polarization

Of one sample of refining sugar received on the 19th of July, 1883, from E. McLeod, Esquire.

Mark.	Polarization.	Colour, D. S.
HC D	95.3 + .3 = 95.60.	

No. 155.

Certificate of polarization

Of one sample of refining sugar received on the 20th of July, 1883, from Messrs. A. W. Perot & Co.

Mark.	Polarization.	Colour, D. S.
[C]	94.0 + .3 = 94.30.	

No. 156.

Certificate of polarization

Of one sample of refining sugar received on the 23d of July, 1883, from Messrs. A. W. Perot & Co.

Mark.	Polarization.	Colour, D. S.
"Martinique"	97.80 + .3 = 98.10°.	

579

No. 157.

Certificate of polarization

Of two samples of refining sugar received on the 23d of July, 1883, from Messrs. A. W. Perot & Co.

Mark.	Polarization.	Colour, D. S.
PE	93.9 + .3 = 94.20°.	
GH	95.0 + .3 = 95.30.	

No. 158.

Certificate of polarization

Of one sample of refining sugar received on the 24th of July, 1884, from Messrs. G. Little & Co.

Mark.	Polarization.	Colour, D. S.
[H] 280 bags, 28 samples.	94.4 + .3 = 94.70°.	

No. 159.

Certificate of polarization

Of a sample of refining sugar received on the 25th of July, 1883, from Messrs. Geo. Little & Company.

Mark.	Polarization.	Colour, D. S.
De K, 304 bags, 30 samples.	95.4 + .3	

No. 160.

Certificate of polarization

Of one sample of refining sugar received on the 26th of July, 1883, from Messrs. Booker Bros. & Co.

Mark.	Polarization.	Colour, D. S.
WA	90.4 + .3 = 90.70°.	

No. 161.

Certificate of polarization

Of one sample of refining sugar received on the 26th of July, 1883, from Messrs. G. Little & Co.

Mark.	Polarization.	Colour, D. S.
G V 20 hhds. No. 293/313	96.4 + .3 = 96.70.	

580

No. 162.

Certificate of polarization

Of one sample of refining sugar received on the 27th of July, 1883, from Messrs. Geo. Little & Co.

Mark.	Polarization.	Colour, D. S.
[GD] 58 hhds., Nos. 770/785, 787/803, 830/855.	94.6 + .3 = 94.90.	

No. 163.

Certificate of polarization

Of one sample of refining sugar received on the 28th of July, 1883, from Messrs. Geo. Little & Co.

Mark.	Polarization.	Colour, D. S.
GV 20 hhds. No. 315/334,	96.2 + .3 = 96.50.	

No. 164.

Certificate of polarization

Of two samples of refining sugar received on the 30th of July, 1883, from Messrs. A. W. Perot & Company.

Mark.	Polarization.	Colour, D. S.
FE 1	94. + .3 = 94.3.	
VF L 2	89.2 + .3 = 89.50.	

No. 165.

Certificate of polarization

Of one sample of refining sugar received on the 30th of July, 1883, from Messrs. A. W. Perot & Company.

Mark.	Polarization.	Colour, D. S
G. H.	95.1 + .3 = 95.40.	

581

No. 166.

Certificate of polarization

Of one sample of refining sugar received on the 31st of July, 1883, from Messrs. G. Little & Co.

Mark.	Polarization.	Colour, D. S.
De K 304 hhds. 39 samples.	95.5 + .3 = 95.80.	

No. 167.

Certificate of polarization

Of one sample of refining sugar received on the 31st of July, 1883, from Messrs. Geo. Little & Co.

Mark.	Polarization.	Colour, D. S.
[GD] 26 hhds. Nos. 882/907.	96.1 + .3 = 96.40.	

No. 168.

Certificate of polarization

Of one sample of refining sugar received on the 31st of July, 1883, from Messrs. Geo. Little & Co.

Mark.	Polarization.	Colour, D. S.
E G 124 bags, 12 samples.	94.2 + .3 = 94.50.	

No. 169.

Certificate of polarization

Of one sample of refining sugar received on the 31st of July, 1883, from Messrs. Geo. Little & Co.

Mark.	Polarization.	Colour, D. S.
[H] 7 hhds. 121 bags.	94.3 + .3 = 94.60.	

No. 170.

Certificate of polarization

Of two samples of refining sugar received on the 1st of August, 1883, from Messrs. A. W. Perot & Company.

Mark.	Polarization.	Colour, D. S.
VF	88.70 + .3 89.00°	
q E	94.2 + .3 = 94.50°	

582

No. 171.

Certificate of polarization

Of one sample of refining sugar received on the 3d of August, 1883, from Messrs. Booker Bros. & Co.

Mark.	Polarization.	Colour, D. S.
[BH] E	88.5 + .3 = 88.80°	

No. 172.

Certificate of polarization

Of one sample of refining sugar received on the 3d of August, 1883, from Messrs. Geo. Little & Co.

Mark.	Polarization.	Colour, D. S.
GV 16 hhds. No. 334/349.	95.3 + .3	95.60.

No. 173

Certificate of polarization

Of one sample of refining sugar received on the 3d of August, 1883, from Messrs. Geo. Little & Co.

Mark.	Polarization.	Colour, D. S.
DEK 51 bags, No. 3655, 3927, 4217, 4301, 5596.	95.60 + .3	95.90°.

No. 174.

Certificate of polarization

Of one sample of refining sugar received on the 3d of August, 1883, from Messrs. Geo. Little & Co.

Mark.	Polarization.	Colour, D. S.
NP 147 bags, 15 samples.	94.7 + .3 = 95.00°.	

No. 175.

Certificate of polarization

Of one sample of refining sugar received on the 3d of August, 1883, from Messrs. Geo. Little & Co.

Mark.	Polarization.	Colour, D. S.
P G 12 hhds. No. 93/104	94.2 + .3 = 94.50°	

583

No. 176.

Certificate of polarization

Of one sample of refining sugar received on the 3d of August, 1883, from Messrs. G. Little & Co.

Mark.	Polarization.	Colour, D. S.
GV 11 hhds. No. 350/360	95.90° + .3 = 96.20	

No. 177.

Certificate of polarization

Of one sample of refining sugar received on the 3d of August, 1883, from Messrs. Geo. Little & Co.

Mark.	Polarization.	Colour, D. S.
PG 12 hhds. No. 105/116	94.8 + .3 = 95.10	

No. 178.

Certificate of polarization

Of one sample of refining sugar received on the 3d of August, 1883, from Messrs. Geo. Little & Co.

Mark.	Polarization.	Colour, D. S.
NP 18 hhds. No. 1/17	94.4 + .3 = 94.70	

No. 179.

Certificate of polarization

Of one sample of refining sugar received on the 4th of August, 1883, from Messrs. Geo. Little & Co.

Mark.	Polarization.	Colour, D. S.
B [v] 18 hhd. D A No. 77/94	94.9 + .3 = 95.20.	

584

No. 180.

Certificate of polarization

Of one sample of refining sugar received on the 7th of August, 1883, from Messrs. Geo. Little & Co.

Mark.	Polarization.	Colour, D. S.
B [v] 20 hhd. D A No. 95/105, 107/115.	95.3 + .3 = 95.60	

No. 181.

Certificate of polarization

Of one sample of refining sugar received on the 7th of August, 1883, from Messrs. Geo. Little & Co.

Mark.	Polarization.	Colour, D. S.
[GD] 21 hhd. No. 928/936, 939/948 985, 988.	94.4 + .3 = 94.70°.	

No. 182.

Certificate of polarization

Of one sample of refining sugar received on the 7th of August, 1883, from Messrs. Geo. Little & Co.

Mark.	Polarization.	Colour, D. S.
NPV 17 hhd., 21 bags No. 19/24, 26, 27, 28/35, 37.	94.9 + .3 = 95.20	

No. 183.

Certificate of polarization

Of two samples of refining sugar received on the 7th of August, 1883, from Messrs. Booker Bros. & Co.

Mark.	Polarization.	Colour, D. S.
B A	94.4 + .3 = 94.70°	
B L	94.9 + .3 = 95.20.	

585

No. 184.

Certificate of polarization

Of one sample of refining sugar received on the 7th of August, 1883, from Messrs. Geo. Little & Co.

Mark.	Polarization.	Colour, D. S.
PG 24 hhds., No. 117/134, 136, 137, 140, 141, 144, 149.	94.4 + .3 = 94.70.	

No. 185.

Certificate of polarization

Of one sample of refining sugar received on the 8th of August, 1883, from Messrs. Geo. Little & Co.

Mark.	Polarization.	Colour, D. S.
B [v] 20 hhds. D A	95.7 + .3 = 96.0°	

No. 186.

Certificate of polarization

Of one sample of refining sugar received on the 8th of August, 1883, from Messrs. Geo. Little & Co.

Mark.	Polarization.	Colour, D. S.
NPv 130 bags, 13 samples,	94.8 + .3 = 95.10.	

No. 187.

Certificate of polarization

Of one sample of refining sugar received on the 8th of August, 1883, from Messrs. Geo. Little & Co.

Mark.	Polarization.	Colour, D. S.
D E K 160 bags, 16 samples.	95.9 + .3 = 96.20.	

586

No. 188.

Certificate of polarization

Of one sample of refining sugar received on the 8th of August, 1883, from Messrs. Geo. Little & Co.

Mark.	Polarization.	Colour, D. S.
B [v] 350 bags, D. A 35 samples,	95.4 + .3 = 95.70	

No. 189.

Certificate of polarization

Of one sample of refining sugar received on the 8th of August, 1883, from Messrs. Geo. Little & Co.

Mark.	Polarization.	Colour, D. S.
B [v] D A 19 samples. 192 bags,	95.4 + .3 = 95.70.	

No. 190.

Certificate of polarization

Of one sample of refining sugar received on the 8th of August, 1883, from Messrs. Geo. Little & Co.

Mark.	Polarization.	Colour, D. S.
[G D] 207 bags, 21 samples.	96.0 + .3 = 96.30.	

No. 191.

Certificate of polarization

Of one sample of refining sugar received on the 9th of August, 1883, from Messrs. Booker Brothers & Co.

Mark.	Polarization.	Colour, D. S.
B	88.8 + .3 = 89.10°.	

587

No. 192.

Certificate of polarization

Of one sample of refining sugar received on the 9th of August, 1883, from F. Grant, Esquire.

Mark.	Polarization.	Colour, D. S.
Pln. Hope E. C.	95.5 + .3 = 95.80°.	

No. 193.

Certificate of polarization

Of two samples of refining sugar received on the 9th of August, 1883, from A. W. Perot & Co.

Mark.	Polarization.	Colour, D. S.
R H	95.9 + .3 = 96.20°.	
q E	94.5 + .3 = 94.80.	

No. 194.

Certificate of polarization

Of one sample of refining sugar received on the 10th of August, 1883, from Messrs. G. Little & Co.

Mark.	Polarization.	Colour, D. S.
PG 5 hhds. 60 bags.	93.5 + 3 = 93.80°.	

No. 195.

Certificate of polarization

Of one sample of refining sugar received on the 10th of August, 1883, from Messrs. G. Little & Co.

Mark.	Polarization.	Colour, D. S.
B. [v] 40 hhds. D. A.	95.20 + .3 = 95.50°	

No. 196.

Certificate of polarization

Of one sample of refining sugar received on the 10th of August, 1883, from Messrs. G. Little & Co.

Mark.	Polarization.	Colour, D. S.
[HV] 232 bags. 23 samples.	95.90 + .3 = 96.20.	

588

No. 197.

Certificate of polarization

Of one sample of refining sugar received on the 10th of August, 1883, from Messrs. Geo. Little & Co.

Mark.	Polarization.	Colour, D. S.
NPv. 196 bags. 19 samples.	94.00 + .3 = 94.30°	

No. 198.

Certificate of polarization

Of three samples of refining sugar received on the 10th of August, 1883, from Messrs. S. Barber & Co.

Mark.		Polarization.	Colour, D. S.
AM. No. 1.	6 trcs.	$80.6 + .3 = 80.90°$	
AM. No. 2.	7 "	$84.5 + .3 = 84.80°$	
LBI.	4 "	$82.3 + .3 = 82.60°$	

No. 199.

Certificate of polarization

Of one sample of refining sugar received on the 10th of August, 1883, from Messrs. Geo. Little & Co.

Mark.	Polarization.	Colour, D. S.
{HV} 221 bags. 21 samples.	$95.7 + .3 = 96.00°$	

No. 200.

Certificate of polarization

Of one sample of refining sugar received on the 10th of August, 1883, from Messrs. Geo. Little & Co.

Mark.	Polarization.	Colour, D. S.
$\frac{B}{D}$ [A] V 180 bags, 18 samples.	$95.4 + .3 = 95.70°$	

589

No. 201.

Certificate of polarization

Of one sample of refining sugar received on the 10th of August, 1883, from Messrs. Geo. Little & Co.

Mark.	Polarization.	Colour, D. S.
$\frac{B}{D}$ [A] V 36 hhds	$95.0 + .3 = 95.30°$	

No. 202.

Certificate of polarization

Of one sample of refining sugar received on the 10th of August, 1883, from Messrs. Geo. Little & Co.

Mark.	Polarization.	Colour, D. S.
[V] 68 bags, 7 samples.	93.9 + .3	94.20°

No. 203.

Certificate of polarization

Of one sample of refining sugar received on the 11th of August, 1883, from P. H. Nind, Esquire.

Mark.	Polarization.	Colour, D. S.
[BH] & [M]E 480 bags.	92.0 + .3 = 92.30°	

No. 204.

Certificate of polarization

Of one sample of refining sugar received on the 11th of August, 1883, from Messrs. G. Little & Co.

Mark.	Polarization.	Colour, D. S.
B D [V]A 50 hhds. No. 182, 183 215/261	96.1 + .3 = 96.40°	

590

No. 204*a*.

Certificate of polarization

Of one sample of refining sugar received on the 11th of August, 1883, from Messrs. Geo. Little & Co.

Mark.	Polarization.	Colour, D. S.
[VP]S 233 bags, 23 samples.	96.0 + .3 = 96.30°	

No. 205.

Certificate of polarization

Of one sample of refining sugar received on the 11th of August, 1883, from Messrs. Geo. Little & Co.

Mark.	Polarization.	Colour, D. S.
NP 147 bags, 15 samples.	94. + .3 = 95.10°	

No. 206.

Certificate of polarization

Of one sample of refining sugar received on the 13th of August, 1883, from Messrs. A. W. Perot & Co.

Mark.	Polarization.	Colour, D. S.
[Z]	95.0 + .3 = 95.30°	

No. 207.

Certificate of polarization

Of one sample of refining sugar received on the 14th of August, 1883, from Messrs. S. Barber & Co.

Mark.	Polarization.	Colour, D. S.
[CG] 25 brls.	77.0 + .3 = 77.30°	

591

No. 208.

Certificate of polarization

Of one sample of refining sugar received on the 15th of August, 1883, from Messrs. G. Little & Co.

Mark.	Polarization.	Colour, D. S.
B [V] 434 bags, D A 44 samples.	95.4 + .3 = 95.70	

No. 209.

Certificate of polarization

Of one sample of refining sugar received on the 15th of August, 1883, from Messrs. Geo. Little & Co.

Mark.	Polarization.	Colour, D. S.
NPv 147 bags, 15 samples.	94. + .3 = 94.30	

No. 210.

Certificate of polarization

Of one sample of refining sugar received on the 16th of August, 1883, from C. Williams, Esq.

Mark.	Polarization.	Colour, D. S.
No mark.	95.2 + .3 = 95.50	

No. 211.

Certificate of polarization

Of one sample of refining sugar received on the 16th of August, 1883, from Messrs. George Little & Co.

Mark.	Polarization.	Colour, D. S.
B D [V] A 36 hhds. No. 271,272, 274, 277/279, 282/289, 326, 338, 340/349,	95.5 + .3 = 95.80	

592

No. 212.

Certificate of polarization

Of one sample of refining sugar received on the 16th of August, 1883, from Messrs. Geo. Little & Co.

Mark.	Polarization.	Colour, D. S.
B [V] D A 37 hhds. No. 289, 326	95.5 + .3 = 95.8	

No. 213.

Certificate of polarization

Of one sample of refining sugar received on the 16th of August, 1883, from Messrs. G. Little & Co.

Mark.	Polarization.	Colour, D. S.
NP 196 bags, 20 samples.	93.6 + .3 = 93.90	

No. 214.

Certificate of polarization

Of one sample of refining sugar received on the 16th of August, 1883, from Messrs. A. W. Perot & Co.

Mark.	Polarization.	Colour, D. S.
J. NP	94.9 + .3 = 95.20°	

No. 215.

Certificate of polarization

Of one sample of refining sugar received on the 17th of August, 1883, from Messrs. Geo. Little & Co.

Mark.	Polarization.	Colour, D. S.
B [V] D A 36 hhds. No. 186, 187, 264, 266, 267, 269, 270, 272/274, 280, 281, 350/358, 360/363, 365/373.	94.8 + .3 = 95.10°	

593

No. 216.

Certificate of polarization

Of one sample of refining sugar received on the 17th of August, 1883, from Messrs. A. W. Perot & Co.

Mark.	Polarization.	Colour, D. S.
qE	92.6 + .3 = 92.90	

No. 217.

Certificate of polarization

Of one sample of refining sugar received on the 17th of August, 1883, from Messrs. A. W. Perot & Co.

Mark.	Polarization.	Colour, D. S.
JJv	94.8 + .3 = 95.10	

No. 218.

Certificate of polarization

Of one sample of refining sugar received on the 18th of August, 1883, from Messrs. Geo. Little & Co.

Mark.	Polarization.	Colour, D. S.
B [V] D A 210 bags, 21 samples.	95.4 + .3	95.70°

No. 219.

Certificate of polarization

Of one sample of refining sugar received on the 18th of August, 1883, from Messrs. Geo. Little & Co.

Mark.	Polarization.	Colour, D. S.
B [V] 29 hhds. D A	94.6 + .3 = 94.90°	

No. 220.

Certificate of polarization

Of one sample of refining sugar received on the 20th of August, 1883, from J. Manifold, Esquire.

Mark.	Polarization.	Colour, D. S.
'11' # T. [Z] 16 152 C	93.4 + .3 = 93.70°	

594

No. 221.

Certificate of polarization

Of two samples of refining sugar received on the 22d of August, 1883, from Messrs. A. W. Perot & Co.

Mark.	Polarization.	Colour, D. S.
[Z]	94 + .3 = 94.3	
qE	93.5 + .3 = 93.80°	

No. 222.

Certificate of polarization

Of one sample of refining sugar received on the 22d of August, 1883, from Messrs. Geo. Little & Co.

Mark.	Polarization.	Colour, D. S.
B [V] 78 hhds. D A 398/442, 448, 450/455, 457, 459, 460, 464, 465/470, 472, 475, 477, 478, 482, 484, 486/488, 490/493, 495, 496, 497, 502.	94.7 + .3 = 95.00	

No. 223.

Certificate of polarization

Of one sample of refining sugar received on the 22d of August, 1883, from Messrs. Geo. Little & Co.

Mark.	Polarization.	Colour, D. S.
NR 245 bags.	95.1 + .3 = 95.40°	

No. 224.

Certificate of polarization

Of one sample of refining sugar received on the 22d of August, 1883, from L. Manifold, Esquire.

Mark.	Polarization.	Colour, D. S.
qE 16 hhds. & 52 tres. from Ph. Bath. 595	93.7 + .3 = 94.00	

No. 225.

Certificate of polarization

Of one sample of refining sugar received on the 24th of August, 1883, from Messrs. G. Little & Co.

Mark.	Polarization.	Colour, D. S.
B 235 [V] 210 D A 207	96.2 + .3 = 96.50	

652 bags.

No. 226.

Certificate of polarization

Of one sample of refining sugar received on the 24th of August, 1883, from Messrs. Geo. Little & Co.

Mark.	Polarization.	Colour, D. S.
B [V] D A 220 bags	96.2 + .3 = 96.50	

No. 227.

Certificate of polarization

Of one sample of refining sugar received on the 24th of Aug., 1883, from Messrs. Geo. Little & Co.

Mark.	Polarization.	Colour, D. S.
NP 98 bags	95.4 + .3 = 95.70	

EXHIBIT E, SUIT 2918.

A Certificates of Polarization, Government Laboratory, Georgetown, Demerara.

No. 470.

Certificate of polarization

Of 1 sample of ref. sugar received on the 8th of Aug., 1884, from Messrs. S. Barber & Co.

Mark.	Polarization.	Colour, D. S.
HB	89.8 + .3 = 90.10	

596

No. 471.

Certificate of polarization

Of 3 samples of refining sugar received on the 12th of August, 1884, from S. Barber & Co.

Mark.	Polarization.	Colour, D. S.
M + E No. 1.	79.6 + .3 = 79.90°	
M + E No. 2.	80.2 + .3 = 80.50°	
M + E No. 3.	81.9 + .3 = 82.20°	

No. 472.

Certificate of polarization

Of 1 sample of ref. sugar received on the 25th of Aug., 1884, from Messrs. S. Barber & Co.

Mark.	Polarization.	Colour, D. S.
HB	85.4 + .3 = 85.70°	

No. 473.

Certificate of polarization

Of 1 sample of ref. sugar received on the 30th of Aug., 1884, from S. Barber & Co.

Mark.	Polarization.	Colour, D. S.
M + E	77.5 + .3 = 77.80°	

No. 474.

Certificate of polarization

Of 1 sample of ref. sugar received on the 2nd of September, 1884, from Messrs. S. Barber & Co.

Mark.	Polarization.	Colour, D. S.
H B	86.1 + .3 = 86.40	

No. 475.

Certificate of polarization

Of 1 sample of ref. sugar received on the 30th of Sept., 1884, from S. Barber & Co.

Mark.	Polarization.	Colour, D. S.
M + E	78.6 + .3 = 78.90°	

597

No. 476.

Certificate of polarization

Of 1 sample of ref. sugar received on the 2nd of October, 1884, from S. Barber & Co.

Mark.	Polarization.	Colour, D. S.
E [N] D	81.5 + .3 = 81.80°	

No. 477.

Certificate of polarization

Of 3 samples of ref. sugar received on the 20th of October, 1884, from Messrs. S. Barber & Co.

Mark.	Polarization.	Colour, D. S.
L. B. I.	$96.2 + .3 = 96.50$	
I C B	$94.6 + .3 = 94.90°$	
U		
R. H.	$97.2 + .3 = 97.50°$	

No. 478.

Certificate of polarization

Of 1 sample of ref. sugar received on the 27th of Oct., 1884, from Messrs. S. Barber & Co.

Mark.	Polarization.	Colour, D. S.
[NP]	$96.4 + .3 = 96.70°$	

No. 479.

Certificate of polarization

Of 1 sample of ref. sugar received on the 31st of October, 1884, from Hm. A. Barr.

Mark.	Polarization.	Colour, D. S.
B [V]		
D A 10 samples	$93.8 + .3 = 94.10°$	

598

No. 480.

Certificate of polarization

Of 1 sample of ref. sugar received on the 4th of Nov., 1884, from Hm. A. Barr.

Mark.	Polarization.	Colour, D. S.
B [V] D A 203 bags 223, 80, 89, 78, 400, 256.	$97.4 + .3 = 97.70°$	

No. 481.

Certificate of polarization

Of 1 sample of ref. sugar received on the 8th of Nov., 1884, from Hm. A. Barr.

Mark.	Polarization.	Colour, D. S.
B [V] D A bags	96.8 + .3 = 97.10°	

No. 482.

Certificate of polarization

Of three samples of refining sugar received on the 8th of November, 1884, from S. Barber & Co.

Mark.	Polarization.	Colour, D. S.
A	96.1 + .3 = 96.40°.	
GW	94.9 + .3 = 95.20°.	
M + E	81.6 + .3 = 81.90°.	

No. 483.

Certificate of polarization

Of 2 samples of refining sugar received on the 11th of November, 1884, from S. Barber & Co.

Mark.	Polarization.	Colour, D. S.
G. V. W.	95.2 + .3 = 95.50.	
S. H	94.3 + .3 = 94.60°.	

599

No. 484.

Certificate of polarization

Of 1 sample of ref. sugar received on the 11th of November, 1884, from S. Barber & Co.

Mark.	Polarization.	Colour, D. S.
MR	87.0 + .3 = 87.30°.	

No. 485.

Certificate of polarization

Of 1 sample of refining sugar received on the 11th of November, 1884, from S. Barber & Co.

Mark.	Polarization.	Colour, D. S.
[NP].	95.4 + .3 = 95.70°.	

No. 486.

Certificate of polarization

Of 1 sample of refining sugar received on the 12th of November, 1884, from S. Barber & Co.

Mark.	Polarization.	Colour, D. S.
G. V. W.	95.7 + .3 = 96.00°.	

No. 487.

Certificate of polarization

Of 1 sample of refining sugar received on the 12th of November, 1884, from S. Barber & Co.

Mark.	Polarization.	Colour, D. S.
[NP]	94.7 + .3 = 95.00°.	

No. 488.

Certificate of polarization

Of 1 sample of refining sugar received on the 13th of November, 1884, from S. Barber & Co.

Mark.	Polarization.	Colour, D. S.
[NP]	94.7 + .3 = 95.00°.	

600

No. 489.

Certificate of polarization

Of 1 sample of refining sugar received on the 13th of November, 1884, from S. Barber & Co.

Mark.	Polarization.	Colour, D. S.
S. H.	95.3 + .3 = 95.60	

No. 490.

Certificate of polarization

Of 1 sample of refining sugar received on the 15th of November, 1884, from S. Barber & Co.

Mark.	Polarization.	Colour, D. S.
[H]	94.6 + .3 = 94.90°	

No 491.

Certificate of polarization

Of 1 sample of yellow sugar received on the 15th of November, 1884, from P. H. Nind, Esq.

Mark.	Polarization.	Colour, D. S.
	94.7 + .3 = 95.00°	

No. 492.

Certificate of polarization

Of 1 sample of refining sugar received on the 17th of November, 1884, from S. Barber & Co.

Mark.	Polarization.	Colour, D. S.
M + E	82.5 + .3 = 82.80°	

No. 493.

Certificate of polarization

Of 1 sample of refining sugar received on the 17th of November, 1884, from S. Barber & Co.

Mark.	Polarization.	Colour, D. S.
M. + E.	81.3 + .3 = 86.60°	

601

No. 494.

Certificate of polarization

Of 1 sample of refining sugar received on the 18th of November, 1884, from S. Barber & Co.

Mark.	Polarization.	Colour, D. S.
H	94.7 + .3 = 95.00°	

No. 495.

Certificate of polarization

Of 1 sample of refining sugar received on the 19th of November, 1884, from S. Barber & Co.

Mark.	Polarization.	Colour, D. S.
[B] V [A] 1st ½	96.7 + .3 = 97.00°	

No. 496.

Certificate of polarization

Of one sample of refining sugar received on the 19th of November, 1884, from S. Barber & Co.

Mark.	Polarization	Colour, D. S.
M + E	82.6 + .3 = 82.90°	

No. 497.

Certificate of polarization

Of two samples of refining sugar received on the 20th of November, 1884, from S. Barber & Co.

Mark.	Polarization.	Colour, D. S.
[NP]	96.9 + .3 = 97.20°	
SH	95.4 + .3 = 95.70°	

No. 498.

Certificate of polarization

Of 1 sample of refining sugar received on the 20th of November, 1884, from S. Barber & Company.

Mark.	Polarization.	Colour, D. S.
G. V. W.	95.9 + .3 = 96.20°	

602

No. 499.

Certificate of polarization

Of 1 sample of refining sugar received on the 21st of November, 1884, from S. Barber & Company.

Mark.	Polarization.	Colour, D. S.
No mark	89.5 + .3 = 89.80°	

No. 500.

Certificate of polarization

Of 1 sample of refining sugar received on the 24th of November, 1884, from A. W. Perot & Company.

Mark.	Polarization.	Colour, D. S.
[A] C. 8 hhds.	94.6 + .3 = 94.90°	

No. 501.

Certificate of polarization

Of 1 sample of refining sugar received on the 28th of November, 1884, from S. Barber & Company.

Mark.	Polarization.	Colour, D. S.
[H]	95.8 + .3 = 96.10	

No. 502.

Certificate of polarization

Of 2 samples of refining sugar received on the 28th of November, 1884, from S. Barber & Company.

Mark.	Polarization.	Colour, D. S.
S. H.	95.7 + .3 = 96.00°	
[NP] A.	96.0 + .3 = 96.30°	

No. 503.

Certificate of polarization

Of 1 sample of refining sugar received on the 4th of December, 1884, from S. Barber & Company.

Mark.	Polarization.	Colour, D. S.
[NP]	96.0 + .3 96.30°	

603

No. 504.

Certificate of polarization

Of 1 sample of refining sugar received on the 10th of December, 1884, from Wm. Smith, Esq.

Mark.	Polarization.	Colour, D. S.
No mark.	94.2 + .3 = 94.50°	

No. 505.

Certificate of polarization

Of 1 sample of refining sugar received on the 10th of Dec., 1884, from the Colonial Co., Limited.

Mark.	Polarization.	Colour, D. S.
A [P] D 25 hhds.	79.9 + .3 = 80.20°	

No. 506.

Certificate of polarization

Of one sample of ref. sugar received on the 11th of Dec'r, 1884, from S. Barber & Co.

Mark.	Polarization.	Colour, D. S.
SXG	95.7 + .3 = 96.00	

No. 507.

Certificate of polarization

Of one sample of ref. sugar received on the 12th of Dec., 1884, from Wm. Smith, Esq.

Mark.	Polarization.	Colour, D. S.
[A]c	94.5 + .3 = 94.80°	

No. 508.

Certificate of polarization

Of 1 sample of refining sugar received on the 13th of December, 1884, from S. Barber & Co.

Mark.	Polarization.	Colour, D. S.
MXB	96.7 + .3 = 97.00°	

604

No. 509.

Certificate of polarization

Of 1 sample of ref. sugar received on the 13th of Dec., 1884, from Wm. Smith, Esq.

Mark.	Polarization.	Colour, D. S.
No mark.	94.0 + .3 = 94.30°	

No. 510.

Certificate of polarization

Of 1 sample of ref. sugar received on the 13th of Dec., 1884, from S. Barber & Co.

Mark.	Polarization.	Colour, D. S.
SXG	94.9 + .3 = 95.20°	

No. 511.

Certificate of polarization

Of 1 sample of ref. sugar received on the 16th of Dec., 1884, from S. Barber & Co.

Mark.	Polarization.	Colour, D. S.
SXG	94.6 + .3 = 94.90°	

No. 512.

Certificate of polarization

Of 3 samples of ref. sugar received on the 18th of Dec., 1884, from S. B. & Co.

Mark.	Polarization.	Colour, D. S.
MXB		
NI	84.0 + .3 = 84.30°	
MXB	95.7 + .3 = 96.00	
SXG	95.0 + .3 = 95.30°	

No. 513.

Certificate of polarization

Of 1 sample of refining sugar received on the 18th of Dec., 1884, from P. H. Nind, Esq.

Mark.	Polarization.	Colour, D. S.
D. C. Vryhaid's test	92.8 + .3 = 93.10°	

605

No. 514.

Certificate of polarization

Of 1 sample of ref. sugar received on the 20th of Dec., 1884, from S. Barber & Co.

Mark.	Polarization.	Colour, D. S.
M + E	86.7 + .3 = 87.00	

No. 515.

Certificate of polarization

Of 1 sample of refining sugar received on the 30th of December, 1884, from Messrs. S. Barber & Co.

Mark.	Polarization.	Colour, D. S.
M + E	82.7 + .3 = 83.00°	

No. 516.

Certificate of polarization

Of 1 sample of ref. sugar received on the 31st of Dec., 1884, from S. Barber & Co.

Mark.	Polarization.	Colour, D. S.
M + B	95.5 + .3 = 95.80°	

No. 517.

Certificate of polarization

Of 1 sample of refining sugar received on the 31st of December, 1884, from S. Barber & Co.

Mark.	Polarization.	Colour, D. S.
M + E 18 hhds.	83.0 + .3 = 83.30°	

No. 518.

Certificate of polarization

Of 1 sample of refining sugar received on the 2d of January, 1885, from S. Barber & Co.

Mark.	Polarization.	Colour, D. S.
[BV]E	95.1 + .3 = 95.40°	

606

No. 519.

Certificate of polarization

Of 1 sample of C. P. sugar received on the 17th of January, 1885, from A. Barr, Esq.

Mark.	Polarization.	Colour, D. S.
[B].	87.6 + .1	

No. 520.

Certificate of polarization

Of 1 sample of refining sugar received on the 12th of January, 1885, from P. H. Nind, Esq.

Mark.	Polarization.	Colour, D. S.
No mark.	93.9 + .3 = 94.20°	

No. 521.

Certificate of polarization

Of 1 sample of refining sugar received on the 13th of January, 1885, from S. Barber & Co.

Mark.	Polarization.	Colour, D. S.
G. S.	83.7 + .3 = 84.00.	

No. 522.

Certificate of polarization

Of 1 sample of ref. sugar received on the 24th of January, 1885, from S. Barber & Co.

Mark.	Polarization.	Colour, D. S.
HB	90.0 + .3 = 90.30°	

No. 523.

Certificate of polarization

Of 1 sample of ref. sugar received on the 27th of Jan'y, 1885, from S. Barber & Co.

Mark.	Polarization.	Colour, D. S.
P	96.5 + .3 = 96.80.	

607

No. 524.

Certificate of polarization

Of 2 samples of refining sugar received on the 27th of January, 1885, from Messrs. A. W. Perot & Co.

Mark.	Polarization.	Colour, D. S.
A	90.5 + .3 = 90.80°	
C	86.1 + .3 = 86.40°	

No. 525.

Certificate of polarization

Of 1 sample of ref. sugar received on the 27th of Jan'y, 1885, from S. Barber & Co.

Mark.	Polarization.	Colour, D. S.
[R]		
[P] G.C.	97.2 + .3 = 97.50°	

No. 526.

Certificate of polarization

Of 1 sample of refining sugar received on the 28th of January, 1885, from Hm. A. Barr.

Mark.	Polarization.	Colour, D. S.
B [V] A 10 hhds.	5.1 + .3 = 95.40°	

No. 527.

Certificate of polarization

Of 1 sample of ref. sugar received on the 28th of January, 1885, from S. Barber & Co.

Mark.	Polarization.	Colour, D. S.
B [V] A	96.2 + .3 = 96.50°	

No. 528.

Certificate of polarization

Of 1 sample of ref. sugar received on the 29th of January, 1885, from S. Barber & Co.

Mark.	Polarization.	Colour, D. S.
[NP] A	97.4 + .3 = 97.70.	

608

No. 529.

Certificate of polarization

Of 1 sample of ref. sugar received on the 31st of January, 1885, from S. Barber & Co.

Mark.	Polarization.	Colour, D. S.
[GD]	96.4 + .3 = 96.70.	

No. 530.

Certificate of polarization

Of 1 sample of ref. sugar received on the 7th of Feb., 1885, from S. Barber & Co.

Mark.	Polarization.	Colour, D. S.
B. A.	95.7 + .3 = 96.00°	

No. 531.

Certificate of polarization

Of 1 sample of ref. sugar received on the 11th of Feb., 1885, from S. Barber & Co.

Mark.	Polarization.	Colour, D. S.
[V]	96.0 + .3 = 96.30°	

No. 532.

Certificate of polarization

Of 1 sample of ref. sugar received on the 12th of Feb., 1885, from Hm. A. Barr.

Mark.	Polarization.	Colour, D. S.
GVW	96.4 + .3 = 96.70	

No. 533.

Certificate of polarization

Of 1 sample of ref. sugar received on the 13th of Feb., 1885, from A. W. Perot & Co.

Mark.	Polarization.	Colour, D. S.
[D]	88.2 + .3 = 88.50	

609

No. 534.

Certificate of polarization

Of 1 sample of ref. sugar received on the 13th of Feb., 1885, from S. Barber & Co.

Mark.	Polarization.	Colour, D. S.
[NP] A	96.2 + .3 = 96.50°	

No. 535.

Certificate of polarization

Of 1 sample of ref. sugar received on the 14th of Feb., 1885, from S. Barber & Co.

Mark.	Polarization.	Colour, D. S.
V[P]S	96.2 + .3 = 96.50°	

No. 536.

Certificate of polarization

Of 1 sample of ref. sugar received on the 17th of Feb., 1885, from S. Barber & Co.

Mark.	Polarization.	Colour, D. S.
B[V]A	95.7 + .3 = 96.00°	

No. 537.

Certificate of polarization

Of 1 sample of ref. sugar received on the 18th of Feb., 1885, from S. Barber & Co.

Mark.	Polarization.	Colour, D. S.
[NP]A	86.3 + .3 = 86.60°	

No. 538.

Certificate of polarization

Of 1 sample of ref. sugar received on the 19th of Feb., 1885, from S. Barber & Co.

Mark.	Polarization.	Colour, D. S.
GVW	95.9 + .3 = 96.20°	

610

No. 539.

Certificate of polarization

Of 1 sample of ref. sugar received on the 24th of Feb., 1885, from S. Barber & Co.

Mark.	Polarization.	Colour, D. S.
[V]S	95.1 + .3 = 95.40°	

No. 546.

Certificate of polarization

Of 2 samples of ref. sugar received on the 24th of Feb., 1885, from Messrs. S. Barber & Co.

Mark.	Polarization.	Colour, D. S.
[V]S 1	96.1 + .3 = 96.40°	
[V]S 3	96.0 + .3 = 96.30°	
[V]S first Sample repeated	95.2 + .3 = 95.50	

No. 541.

Certificate of polarization

Of 1 sample of ref. sugar received on the 25th of February, 1885, from S. Barber & Co.

Mark.	Polarization.	Colour, D. S.
[V]s	95.4 + .3 = 95.70°	

No. 542.

Certificate of polarization

Of 1 sample of ref. sugar received on the 25th of February, 1885, from Messrs. Booker Bros. & Co.

Mark.	Polarization.	Colour, D. S.
WR	95.9 + .3 = 96.20°	

No. 543.

Certificate of polarization

Of 1 sample of C. P. sugar received on the 26th of February, 1885, from S. Barber & Co.

Mark.	Polarization.	Colour, D. S.
HB	88.3 + .3 = 88.60°	

611

No. 544.

Certificate of polarization

Of 1 sample of ref. sugar received on the 26th of February, 1885, from S. Barber & Co.

Mark.	Polarization.	Colour, D. S.
[V]s	95.5 + .3 = 95.80°	

No. 545.

Certificate of polarization

Of 1 sample of ref. sugar received on the 27th of February, 1885, from S. Barber & Co.

Mark.	Polarization.	Colour, D. S.
P. C.	78.7 + .3 = 79.00°	

No. 546.

Certificate of polarization

Of 1 sample of ref. sugar received on the 2d of March, 1885, from S. Barber & Co.

Mark.	Polarization.	Colour, D. S.
M + E	87.2 + .3 =87.50.	

No. 547.

Certificate of polarization

Of 1 sample of ref. sugar received on the 3d of March, 1885, from S. Barber & Company.

Mark.	Polarization.	Colour, D. S.
PE	96.8 + .3 = 97.10°	

No. 548.

Certificate of polarization

Of 1 sample of ref. sugar received on the 4th of March, 1885, from Hm. A. Barr.

Mark.	Polarization.	Colour, D. S.
M + E 1076/1183 108 hhds.	86.7 + .3 = 87.00°	

612

No. 549.

Certificate of polarization

Of 1 sample of ref. sugar received on the 4th of March, 1885, from Hm. A. Barr.

Mark.	Polarization.	Colour. D. S.
M + E 1184/1219 36 hhds.	83.9 + .3 = 84.20	

No. 550.

Certificate of polarization

Of 1 sample of ref. sugar received on the 4th of March, 1885, from Hm. A. Barr.

Mark.	Polarization.	Colour, D. S.
M + E 1220/1268 49 hhds.	76.2 + .3 = 76.50°	

No. 551.

Certificate of polarization

Of 1 sample of ref. sugar received on the 4th of March, 1885, from Hm. A. Barr.

Mark.	Polarization.	Colour, D. S.
M + E 1269/1313 45 hhds.	82.5 + .3 = 82.80°	

No. 552.

Certificate of polarization

Of 2 samples of ref. sugar received on the 10th of March, 1885, from Messrs. S. Barber & Company.

Mark.	Polarization.	Colour, D. S.
[Z] bags	92.7 + .3 = 93.00°	
[Z] hhds.	94.5 + .3 = 94.80°	

No. 553.

Certificate of polarization

Of 1 sample of ref. sugar received on the 11th of March, 1885, from S. Barber & Company.

Mark.	Polarization.	Colour, D. S.
GVW	98.6 + .3 = 93.90°	

613

No. 554.

Certificate of polarization

Of 3 samples of ref. sugar received on the 11th of March, 1885, from S. Barber & Company.

Mark.	Polarization.	Colour, D. S.
GVW bags No. 1	95.7 + .3 = 96.00°	
GVW hhds. No. 2	95.6 + .3 = 95.90°	
GVW bags No. 2	94.6 + .3 = 94.90°	

No. 555.

Certificate of polarization

Of 1 sample of ref. sugar received on the 11th of March, 1885, from S. Barber & Company.

Mark	Polarization.	Colour, D. S.
GVW	94.5 + .3 = 94.80°	

No. 556.

Certificate of polarization

Of 1 sample of ref. sugar received on the 13th of March, 1885, from S. Barber & Co.

Mark.	Polarization.	Colour, D. S.
[NP] A	95.5 + .3 = 95.80°	

No. 557.

Certificate of polarization

Of 1 sample of ref. sugar received on the 16th of March, 1885, from A. W. Perot & Co.

Mark.	Polarization.	Colour, D. S.
TP E	89.4 + .3 = 89.70	

No. 558.

Certificate of polarization

Of 2 samples of ref. sugar received on the 18th of March, 1885, from Hm. A. Barr.

Mark.	Polarization.	Colour. D. S.
GVW hhds.	94.3 + .3 = 94.60°	
GVW bags.	95.0 + .3 = 95.30°	

No. 559.

Certificate of polarization

Of 1 sample of ref. sugar received on the 18th of March, 1885, from S. Barber & Co.

Mark.	Polarization.	Colour, D. S.
GVW	96.1 + .3 = 96.40°	

No. 560.

Certificate of polarization

Of 2 samples of ref. sugar received on the 18th of March, 1885, from S. Barber & Co.

Mark.	Polarization.	Colour, D. S.
E[N]D No.1	83.7 + .3 = 84.00°	
E[N]D No. 2	77.5 + .3 = 77.80°	

No. 561.

Certificate of polarization

Of 1 sample of regf. sugar received on the 20th of March, 1885, from S. Barber & Co.

Mark.	Polarization.	Colour, D. S.
CXJ	92.1 + .3 = 92.40°	

No. 562.

Certificate of polarization

Of 1 sample of ref. sugar received on the 24th of March, 1885, from S. Barber & Co.

Mark.	Polarization.	Colour, D. S.
M + E	87.7 + .3 = 88.00°	

No. 563.

Certificate of polarization

Of 1 sample of ref. sugar received on the 25th of March, 1885, from S. Barber & Co.

Mark.	Polarization.	Colour, D. S.
GVW	95.0 + .3 = 95.3	

No. 564.

Certificate of polarization

Of 1 sample of ref. sugar received on the 26th of March, 1885, from S. Barber & Co.

Mark.	Polarization.	Colour, D. S.
GVW	95.2 + .3 = 95.50°	

No. 565.

Certificate of polarization

Of 2 samples of ref. sugar received on the 31st of March, 1885, from S. B. & Co.

Mark.	Polarization.	Colour, D. S.
GVW	95.7 + .3 = 96.00°	
[H]	96.0 + .3 = 96.30°	

No. 566.

Certificate of polarization

Of one sample of ref. sugar received on the 4th of April, 1885, from S. Barber & Co.

Mark.	Polarization.	Colour. D. S.
CxJ	92.0 + .3 = 92.30°	

No. 567.

Certificate of polarization

Of 1 sample of ref. sugar received on the 9th of April, 1885, from S. Barber & Co.

Mark.	Polarization.	Colour, D. S.
E [N] D	79.7 + .3 = 80.00°	

No. 568.

Certificate of polarization

Of 1 sample of ref. sugar received on the 11th of April, 1885, from S. Barber & Co.

Mark.	Polarization.	Colour, D. S.
GVW	94.1 + .3 = 94.40	

616

No. 569.

Certificate of polarization

Of 1 sample of ref. sugar received on the 13th of April, 1885, from S. Barber & Co.

Mark.	Polarization.	Colour, D. S.
GVW	95.7 + .3 = 96.00°	

No. 570.

Certificate of polarization

Of 1 sample of ref. sugar received on the 13th of April, 1885, from S. Barber & Co.

Mark.	Polarization.	Colour, D. S.
[B]	97.1 + .3 = 97.40°	

No. 571.

Certificate of polarization

Of 4 samples of ref. sugar received on the 15th of April, 1885, from S. Barber & Co.

Mark.	Polarization.	Colour, D. S.
Lot 36	87.3 + .3 = 87.60°	
" 45	86.1 + .3 = 86.40	
" 49	80.1 + .3 = 80.40	
" 108	87.0 + .3 = 87.30	

No. 572.

Certificate of polarization

Of 1 sample of ref. sugar received on the 29th of April, 1885, from S. Barber & Co.

Mark.	Polarization.	Colour, D. S.
GVW	93.7 + .3 = 94.00°	

No. 573.

Certificate of polarization

Of 1 sample of ref. sugar received on the 1st of May, 1885, from S. Barber & Co.

Mark.	Polarization.	Colour, D. S.
PHE	89.2 + .3 = 89.50°	

617

No. 574.

Certificate of polarization

Of 1 sample of ref. sugar received on the 6th of May, 1885, from S. Barber & Co.

Mark.	Polarization.	Colour, D. S.
PE	95.5 + .3 = 95.80°	

No. 575.

Certificate of polarization

Of 1 sample of ref. sugar received on the 6th of May, 1885, from Messrs. A. W. Perot & Co.

Mark.	Polarization.	Colour, D. S.
GV 960 bags.	95.9 + .3 = 96.20°	

No. 576.

Certificate of polarization

Of 1 sample of ref. sugar received on the 13th of May, 1885, from E. McLeod, Esq.

Mark.	Polarization.	Colour, D. S.
[NP]A	94.2 + .3 = 94.50	

No. 577.

Certificate of polarization

Of 2 samples of ref. sugar received on the 16th of May, 1885, from S. Barber & Co.

Mark.	Polarization.	Colour, D. S.
Lot 334	95.5 + .3 = 95.80°	
Lot 500	95.2 + .3 = 95.50°	

No. 578.

Certificate of polarization

Of 1 sample of ref. sugar received on the 2d of June, 1885, from S. Barber & Co.

Mark.	Polarization.	Colour, D. S.
E [N]D	80.4 + .3 = 80.70°	

618

No. 579.

Certificate of polarization

Of 1 sample of ref. sugar received on the 16th of June, 1885, from A. W. Perot & Co.

Mark.	Polarization.	Colour, D. S.
No mark.	96.0 + .3 = 96.30°	

No. 580.

Certificate of polarization

Of 1 sample of ref. sugar received on the 3d of July, 1885, from S. Barber & Co.

Mark.	Polarization.	Colour, D. S.
[H]	96.6 + .3 = 96.90°	

No. 581.

Certificate of polarization

Of 1 sample of C. P. sugar received on the 8th of July, 1885, from S. Barber & Co.

Mark.	Polarization.	Colour, D. S.
A[P]D	81.0 + .3 = 81.30°	

No. 582.

Certificate of polarization

Of 1 sample of ref. sugar received on the 14th of August, 1885, from Messrs. S. Barber & Co.

Mark.	Polarization.	Colour, D. S.
Ac	95.2 + .3 = 95.50°	

No. 583.

Certificate of polarization

Of 1 sample of ref. sugar received on the 24th of August, 1885, from S. Barber & Co.

Mark.	Polarization.	Colour, D. S.
ZW	94.9 + .3 = 95.2	

619

No. 584.

Certificate of polarization

Of 1 sample of refining sugar received on the 2d of September, 1885, from S. Barber & Co.

Mark.	Polarization.	Colour, D. S.
SXG	92.8 + .3 = 93.10°	

No. 585.

Certificate of polarization

Of 1 sample of ref. sugar received on the 3d of September, 1885, from S. Barber & Co.

Mark.	Polarization.	Colour, D. S.
SXG	95.2 + .3 = 95.50°	

No. 586.

Certificate of polarization

Of 1 sample of ref. sugar received on the 4th of September, 1885, from S. Barber & Co.

Mark.	Polarization.	Colour, D. S.
SXG	$97.2 + .3 = 97.50°$	

No. 587.

Certificate of polarization

Of 1 sample of ref. sugar received on the 19th of September, 1885, from S. Barber & Co.

Mark.	Polarization.	Colour, D. S.
T. D. V.	$95.5 + .3 = 95.80°$	

No. 588.

Certificate of polarization

Of 1 sample of ref. sugar received on the 21st of September, 1885, from S. Barber & Co.

Mark.	Polarization.	Colour, D. S.
R. H.	$96.0 + .3 = 96.30°$	

620

No. 589.

Certificate of polarization

Of 1 sample of ref. sugar received on the 3d of October, 1885, from S. Barber & Co.

Mark.	Polarization.	Colour, D. S.
[BV]E	$48.1 + .3 = 48.4$	
	2	
	96.6	

No. 590.

Certificate of polarization

Of 1 sample of non-chemical sugar received on the 7th of October, 1885, from S. Barber & Co.

Mark.	Polarization.	Colour, D. S.
S. ✕ G.	$95.6 + .3 = 95.90°$	

No. 591.

Certificate of polarization

Of 1 sample of ref. sugar received on the 7th of October, 1885, from Messrs. S. Barber & Co.

Mark.	Polarization.	Colour, D. S.
HV	93.9 + .3 = 94.20°	

No. 592.

Certificate of polarization

Of 1 sample of ref. sugar received on the 8th of October, 1885, from S. Barber & Co.

Mark.	Polarization.	Colour, D. S.
S. ✕ C.	96.2 + .3 = 96.50°	

No. 593.

Certificate of polarization

Of 1 sample of ref. sugar received on the 9th of October, 1885, from S. Barber & Co.

Mark.	Polarization.	Colour, D. S.
S. ✕ G.	95.8 + .3 = 96.10°	

621

No. 594.

Certificate of polarization

Of 1 sample of ref. sugar received on the 10th of October, 1885, from S. Barber & Co.

Mark.	Polarization.	Colour, D. S.
[BV] E	96.7 + .3 = 97.00°	

No. 595.

Certificate of polarization

Of 1 sample of ref. sugar received on the 13th of October, 1885, from S. Barber & Co.

Mark.	Polarization.	Colour, D. S.
[HV]	94 + .3 = 94.3	

No. 596.

Certificate of polarization

Of 2 samples of ref. sugar received on the 13th of October, 1885, from Hm. A. Barr.

Mark.	Polarization.	Colour, D. S.
No. 1.	95.0 + .3 = 95.30°	
No. 2.	95.3 + .3 = 95.60°	

No. 597.

Certificate of polarization

Of 1 sample of ref. sugar received on the 14th of October, 1885, from S. Barber & Co.

Mark.	Polarization.	Colour, D. S.
[H] H	94.2 + .3 = 94.50°	

No. 598.

Certificate of polarization

Of 1 sample of ref. sugar received on the 14 of Oct., 1885, from S. Barber & Co.

Mark.	Polarization.	Colour, D. S.
M × E	78.5 + .3 = 78.80°	

622

No. 599.

Certificate of polarization

Of 1 sample of ref. sugar received on the 15th of October, 1885, from S. Barber & Co.

Mark.	Polarization.	Colour, D. S.
[V]	91.0 + .3 = 91.30°	

No. 600.

Certificate of polarization

Of 1 sample of ref. sugar received on the 15th of Oct., 1885, from Hm. A. Barr.

Mark.	Polarization.	Colour, D. S.
No mark.	96.7 + .3 = 97.00	

No. 601.

Certificate of polarization

Of 1 sample of ref. sugar received on the 16th of Oct., 1885, from Landbach, Parker & Co.

Mark.	Polarization.	Colour, D. S.
No mark.	94.2 + .3 = 94.50	

No. 602.

Certificate of polarization

Of 1 sample of ref. sugar received on the 20th of Oct., 1885, from S. Barber & Co.

Mark.	Polarization.	Colour, D. S.
[HV]	94.2 + .3 = 94.50	

No. 603.

Certificate of polarization

Of 1 sample of ref. sugar received on the 22d of October, 1885, from S. Barber & Co.

Mark.	Polarization.	Colour, D. S.
[H]	92.1 + .3 = 92.40°	

623

No. 604.

Certificate of polarization

Of 1 sample of ref. sugar received on the 23d of Oct., 1885, from S. Barber & Co.

Mark.	Polarization.	Colour, D. S.
[HV]	94.0 + .3 = 94.30°	

No. 605.

Certificate of polarization

Of 1 sample of ref. sugar received on the 26th of October, 1885, from S. Barber & Co.

Mark.	Polarization.	Colour, D. S.
[S]	93.3 + .3 = 93.60°	
[WR]		

No. 606.

Certificate of polarization

Of 2 samples of ref. sugar received on the 29th of Oct., 1885, from S. Barber & Co.

Mark.	Polarization.	Colour, D. S.
[H] hhds.	92.6 + .3 = 92.90	
[H] bags.	91.4 + .3 = 91.70	

No. 607.

Certificate of polarization

Of 2 samples of ref. sugar received on the 30th of Oct., 1885, from S. Barber & Co.

Mark.	Polarization.	Colour, D. S.
[A]c 100	94.5 + .3 = 94.80°	
[A]c 160	94.4 + .3 = 94.70°	

No. 608.

Certificate of polarization

Of 1 sample of ref. sugar received on the 31st of Oct., 1885, from S. Barber & Co.

Mark.	Polarization.	Colour, D. S.
[BV] 168 bags.	93.7 + .3 = 94.00°	

624

No. 609.

Certificate of polarization

Of 1 sample of ref. sugar received on the 2d of Nov., 1885, from S. Barber & Co.

Mark.	Polarization.	Colour, D. S.
[H]	93.3 + .3 = 93.60°	

No. 610.

Certificate of polarization

Of one sample of ref. sugar received on the 4th of Nov., 1885, from S. Barber & Co.

Mark.	Polarization.	Colour, D. S.
AC	95.5 + .3 = 95.80°	

No. 611.

Certificate of polarization

Of three samples of ref. sugar received on the 6th of Nov., 1885, from S. Barber & Co.

Mark.	Polarization.	Colour, D. S.
[BV]	93.0 + .3 = 93.30°	
[AC]	94.2 + .3 = 94.50°	
[CI]	94.1 + .3 = 94.40°	

No. 612.

Certificate of polarization

Of one sample of ref. sugar received on the 7th of Nov., 1885, from S. Barber & Co.

Mark.	Polarization.	Colour, D. S.
[H]	94.2 + .3 = 94.50°	

No. 613.

Certificate of polarization

Of 2 samples of ref. sugar received on the 7th of Nov., 1885, from S. Barber & Co.

Mark.	Polarization.	Colour, D. S.
[A]C	95.1 + .3 = 95.40°	
[CI]	96 + .3 = 96.30°	

625

No. 614.

Certificate of polarization

Of 1 sample of ref. sugar received on the 9th of Nov., 1885, from S. Barber & Co.

Mark.	Polarization.	Colours, D. S.
[A]C	94 + .3 = 94.30°	

No. 615.

Certificate of polarization

Of 3 samples of ref. sugar received on the 11th of Nov., 1885, from S. Barber & Co.

Mark.	Polarization.	Colour, D. S.
[CI] No. 1	94.5 + .3 = 94.80°	
GV	93.1 + .3 = 93.40°	
[C]D	95.0 + .3 = 95.30°	

No. 616.

Certificate of polarization

Of 1 sample ref. sugar received on the 12th of Nov., 1885, from S. Barber & Co.

Mark.	Polarization.	Colour, D. S.
[CI]	95.3 + .3 = 95.60°	

No. 617.

Certificate of polarization

Of 1 sample of ref. sugar received on the 13th of Nov., 1885, from S. Barber & Co.

Mark.	Polarization.	Colour, D. S.
GV	95.3 + .3 = 95.60°	

No. 618.

Certificate of polarization

Of 1 sample of ref. sugar received on the 13th of Nov., 1885, from S. Barber & Co.

Mark.	Polarization.	Colour, D. S.
[CI]	94.90 + .3 = 95.20°	

626

No. 619.

Certificate of polarization

Of 1 sample of ref. sugar received on the 14th of Nov., 1885, from S. Barber & Co.

Mark.	Polarization.	Colour, D. S.
GV	93.5 + .3 = 93.80°	

No. 620.

Certificate of polarization

Of 1 sample of ref. sugar received on the 14th of Nov., 1885, from S. Barber & Co.

Mark.	Polarization.	Colour, D. S.
BV	92.3 + .3 = 92.60°	

No. 621.

Certificate of polarization

Of 1 sample of ref. sugar received on the 14th of Nov., 1885, from S. Barber & Co.

Mark.	Polarization.	Colour, D. S.
[CI]	94.7 + .3 = 95.00	

No. 622.

Certificate of polarization

Of 1 sample of ref. sugar received on the 14th of Nov., 1885, from Wm. Smith, Esq.

Mark.	Polarization.	Colour, D. S.
:-	94.2 + .3 = 94.50.	

No. 623.

Certificate of polarization

Of 1 sample of ref. sugar received on the 17th of November, 1885, from S. Barber & Co.

Mark.	Polarization.	Colour, D. S.
GV	93.5 + .3 = 93.80°	

627

No. 624.

Certificate of polarization

Of 1 sample of ref. sugar received on the 18th of Nov., 1885, from S. Barber & Co.

Mark.	Polarization.	Colour, D. S.
[CI]	95.3 + .3 = 95.60°	

No. 625.

Certificate of polarization

Of 1 sample of ref. sugar received on the 19th of Nov., 1885, from S. Barber & Co.

Mark.	Polarization.	Colour, D. S.
[CI]	95.0 + .3 = 95.30°	

No. 626.

Certificate of polarization

Of 1 sample of ref. sugar received on the 19th of Nov., 1885, from S. Barber & Co.

Mark.	Polarization.	Colour, D. S.
[C]D	94.2 + .3 = 94.50°	

No. 627.

Certificate of polarization

Of 1 sample of ref. sugar received on the 20th of Nov., 1885, from S. Barber & Co.

Mark.	Polarization.	Colour, D. S.
[C]D	94.2 + .3 = 94.50	

No. 628.

Certificate of polarization

Of 1 sample of ref. sugar received on the 20th of Nov., 1885, from S. Barber & Co.

Mark.	Polarization.	Colour, D. S.
BV 168 bags.	93.1 + .3 = 93.40°	

628

No. 629.

Certificate of polarization

Of 1 sample of ref. sugar received on the 20th of Nov., 1885, from A. S. Barber & Co.

Mark.	Polarization.	Colour, D. S.
[C I]	94.9 + .3 = 95.20°	

No. 630.

Certificate of polarization

Of 1 sample of ref. sugar received on the 20th of Nov., 1885, from A. S. Barber & Co.

Mark.	Polarization.	Colour, D. S.
[V]S	91.6 + .3 = 91.90°	

No. 631.

Certificate of polarization

Of 1 sample of ref. sugar received on the 21st of Nov., 1885 from S. Barber & Co.

Mark.	Polarization.	Colour, D. S.
[S] N. C.	94.8 + .3 = 95.10	

No. 632.

Certificate of polarization

Of 1 sample of ref. sugar received on the 21st of Nov., 1885, from S. Barber & Co.

Mark.	Polarization.	Colour, D. S.
G V	92.5 + .3 = 92.80°	

No. 633.

Certificate of polarization

Of 1 sample of ref. sugar received on the 23d of Nov., 1886, from S. Barber & Co.

Mark.	Polarization.	Colour, D. S.
[C I] 21/11/85	94.0 + .3 = 94.30	

629

No. 634.

Certificate of polarization

Of 1 sample of ref. sugar received on the 23d of Nov., 1885, from S. Barber & Co.

Mark.	Polarization.	Colour, D. S.
[C I] 23/11/85	94.8 + .3 = 95.10°	

No. 635.

Certificate of polarization

Of 1 sample of ref. sugar received on the 24th of Nov., 1885, from S. Barber & Co.

Mark.	Polarization.	Colour, D. S.
[A]C. 176 bags	94.3 + .3 = 94.60.	

No. 636.

Certificate of polarization

Of 1 sample of ref. sugar received on the 24th of Nov., 1885, from S. Barber & Co.

Mark.	Polarization.	Colour, D. S.
CI.	$94.7 + .3 = 95.00°$	

No. 637.

Certificate of polarization

Of 1 sample of C. P. sugar received on the 24th of Nov., 1885, from S. Barber & Co.

Mark.	Polarization.	Colour, D. S.
M + E.	$79.5 + .3 = 79.80°$	

No. 638.

Certificate of polarization

Of 1 sample of ref. sugar received on the 25th of Nov., 1885, from S. Barber & Co.

Mark.	Polarization.	Colour, D. S.
[A] C	$94.2 + .3 = 94.50°$	

630

No. 639.

Certificate of polarization

Of 1 sample of ref. sugar received on the 25th of Nov., 1885, from S. Barber & Co.

Mark.	Polarization.	Colour, D. S.
[BV]	$94.2 + .3 = 94.50°$	

No. 640.

Certificate of polarization

Of 1 sample of ref. sugar received on the 25th of Nov., 1885, from S. Barber & Co.

Mark.	Polarization.	Colour, D. S.
[C] D	$94.6 + .3 = 94.90°$	

No. 641.

Certificate of polarization

Of 1 sample of ref. sugar received on the 26th of Nov., 1885, from S. Barber & Co.

Mark.	Polarization.	Colour, D. S.
[CI]	$95.5 + .3 = 95.80°$	

No. 642.

Certificate of polarization

Of 1 sample of ref. sugar received on the 26th of Nov., 1885, from S. Barber & Co.

Mark.	Polarization.	Colour, D. S.
[C] D	$94.2 + .3 = 94.50°$	

No. 643.

Certificate of polarization

Of 1 sample of C. P. sugar received on the 26th of Nov., 1885, from S. Barber & Co.

Mark.	Polarization.	Colour, D. S.
H B	$81.5 + .3 = 81.80°$	

631

No. 644.

Certificate of polarization

Of 1 sample of C. P. sugar received on the 26th of Nov., 1885, from S. Barber & Co.

Mark.	Polarization.	Colour, D. S.
P C	$78.5 + .3 = 78.80°$	

No. 645.

Certificate of polarization

Of 1 sample of ref. sugar received on the 26th of Nov., 1885, from Landbach, Parker & Co.

Mark.	Polarization.	Colour, D. S.
Wales	$93.0 + .3 = 93.30°$	

No. 646.

Certificate of polarization

Of 1 sample of ref. sugar received on the 27th of Nov., 1885, from S. Barber & Co.

Mark.	Polarization.	Colour, D. S.
[A]C	94 + .3 = 94.30	

No. 647.

Certificate of polarization

Of 1 sample of ref. sugar received on the 27th of Nov., 1885, from S. Barber & Co.

Mark.	Polarization.	Colour, D. S.
[C]I	94.9 + .3 = 95.2	

No. 648.

Certificate of polarization

Of 1 sample of ref. sugar received on the 30th of Nov., 1885, from Messrs. S. Barber & Co.

Mark.	Polarization.	Colour, D. S.
[A]C	93.5 + .3 = 93.8	

632

No. 649.

Certificate of polarization

Of 1 sample of ref. sugar received on the 30th of Nov., 1885, from Messrs. S. Barber & Co.

Mark.	Polarization.	Colour, D. S.
[C]1	95. + .3 = 95.3	

No. 650.

Certificate of polarization

Of one sample of syrup sugar received on the 1st of Dec., 1885, from Landbach, Parker & Co.

Mark.	Polarization.	Colour, D. S.
No mark	92.6 + .3 = 92.9	

No. 651.

Certificate of polarization

Of one sample C. P. sugar received on the 2d of Dec., 1885 from S. Barber & Co.

Mark.	Polarization.	Colour, D. S.
HB	82.2 + .3 = 82.5	

No. 652.

Certificate of polarization

Of 1 sample of ref. sugar received on the 3d of Dec., 1885, from S. Barber & Co.

Mark.	Polarization.	Colour, D. S.
[CI]	95.3 + .3 = 95.6	

No. 653.

Certificate of polarization

Of 1 sample of ref. sugar received on the 3d of Dec., 1885, from S. Barber & Co.

Mark.	Polarization.	Colour, D. S.
[A]c	94.5 + .3 = 94.8	

633

No. 654.

Certificate of polarization

Of 1 sample of ref. sugar received on the 4th of Dec., 1885, from Sam'l Barber & Co.

Mark.	Polarization.	Colour, D. S.
PY	93.7 = 94.	

No. 655.

Certificate of polarization

Of 1 sample of ref. sugar received on the 4th of Dec., 1885, from S. Barber & Co.

Mark.	Polarization.	Colour, D. S.
[CI]	95.5 + .3 = 95.8	

No. 656.

Certificate of polarization

Of 1 sample ref. sugar received on the 8th of Dec., 1885, from S. Barber & Co.

Mark.	Polarization.	Colour, D. S.
C [SM]	93.2 + .3 = 93.5	

No. 657.

Certificate of polarization

Of 1 sample ref. sugar received on the 8th of Dec., 1885, from S. Barber & Co.

Mark.	Polarization.	Colour, D. S.
I C B U	96. + .3 = 96.3	

No. 658.

Certificate of polarization

Of 1 sample ref. sugar received on the 8th of Dec., 1885, from E. McLeod.

Mark.	Polarization.	Colour, D. S.
[CL]	95.5 + .3 = 95.8	

634

No. 659.

Certificate of polarization

Of 1 sample of ref. sugar received on the 8th of December, 1885, from E. McLeod.

Mark.	Polarization.	Colour, D. S.
[A]C	95.1 + .3 = 95.4	

No. 660.

Certificate of polarization

Of 1 sample of ref. sugar received on the 9th of Dec., 1885, from S. Barber & Co.

Mark.	Polarization.	Colour, D. S.
S&G	95.7 + .3 = 96	

No. 661.

Certificate of polarization

Of 1 sample of ref. sugar received on the 9th of Dec., 1885, from S. Barber & Co.

Mark.	Polarization.	Colour, D. S.
TDV	95.7 + .3 = 96	

No. 662.

Certificate of polarization

Of 1 sample of ref. sugar received on the 9th of Dec., 1885, from S. Barber & Co.

Mark.	Polarization.	Colour, D. S.
RH	94.5 + .3 = 94.8	

No. 663.

Certificate of polarization

Of 1 sample of ref. sugar received on the 9th of Dec., 1885, from S. Barber & Co.

Mark.	Polarization.	Colour, D. S.
PW	95.1 + .3 = 95.4	

635

No. 664.

Certificate of polarization

O- 1 sample of ref. sugar received on the 9th of Dec., 188-, from S. Barber & Co.

Mark.	Polarization.	Colour, D. S.
GV	93.8 + .3 = 94.1	

No. 665.

Certificate of polarization

Of 1 sample of ref. sugar received on the 10th of Dec., 1885, from E. McLeod.

Mark.	Polarization.	Colour, D. S.
[C]D	94. + .3 = 94.3	

No. 666.

Certificate of polarization

Of 1 sample of ref. sugar received on the 10th of Dec., 1885, from S. Barber & Co.

Mark.	Polarization.	Colour, D. S.
C [M] S	95.4 + .3 = 95.7	

No. 667.

Certificate of polarization

Of 1 sample of ref. sugar received on the 10th of Dec., 1885, from S. Barber & Co.

Mark.	Polarization.	Colour, D. S.
Z	95.	

No. 668.

Certificate of polarization

Of 1 sample of ref. sugar received on the 11th of Dec., 1885, from S. Barber & Co.

Mark.	Polarization.	Colour, D. S.
L B I	95.3 + .3 = 95.6	

636

No. 669.

Certificate of polarization

Of 1 sample of ref. sugar received on the 11th of Dec., 1885, from S. Barber & Co.

Mark.	Polarization.	Colour, D. S.
M + B	94.7 + .3 = 95.	

No. 670.

Certificate of polarization

Of 1 sample of muscovad*a* sugar received on the 12th of Dec., 1885, from S. Barber & Co.

Mark.	Polarization.	Colour, D. S.
HB	82.5 + .3 = 82.8	

No. 671.

Certificate of polarization

Of 1 sample of muscovado sugar received on the 12th of Dec., 1885, from S. Barber & Co.

Mark.	Polarization.	Colour, D. S.
MxE	83.7 + .3 = 84.	

No. 672.

Certificate of polarization

Of 1 sample of ref. sugar received on the 12th of Dec., 1885, from E. McLeod.

Mark.	Polarization.	Colour, D. S.
[C] D	93.3 + .3 = 93.6	

No. 673.

Certificate of polarization

Of 1 sample of muscovado sugar received on the 14th Dec., 1885, from A. W. Perot & Co.

Mark.	Polarization.	Colour, D. S.
[D]	78.4 + .3 = 78.7	

637

No. 674.

Certificate of polarization

Of 1 sample of ref. sugar received on the 14th of Dec., 1885, from Hon. A. Barr.

Mark.	Polarization.	Colour, D. S.
L	96.1 + .3 = 96.4	

No. 675.

Certificate of polarization

Of 1 sample of ref. sugar received on the 14th of Dec., 1885, from Hon. A. Barr.

Mark.	Polarization.	Colour, D. S.
A	96.1 + .3 = 96.4	

No. 676.

Certificate of polarization

Of 1 sample of ref. sugar received on the 15th of Dec., 1885, from Walter Bagot, Esq.

Mark.	Polarization.	Colour, D. S.
W B	95. + .3 = 95.3	

No. 677.

Certificate of polarization

Of 1 sample of ref. sugar received on the 15th of Dec., 1885, from Sam'l Barber & Co.

Mark.	Polarization.	Colour, D. S.
S + G	95.7 + .3 = 96.	

No. 678.

Certificate of polarization

Of 1 sample of ref. sugar received on the 16th of Dec., 1885, from S. Barber & Co.

Mark.	Polarization.	Colour, D. S.
MB	95.2 + .3 = 95.5	

No. 679.

Certificate of polarization

Of 1 sample of ref. sugar received on the 17th of Dec., 1885, from Messrs. S. Barber & Co.

Mark.	Polarization.	Colour, D. S.
C & J	95.5 + .3 = 95.8	

No. 680.

Certificate of polarization

Of 1 sample of ref. sugar received on the 17th of Dec., 1885, from Edwin McLeod.

Mark.	Polarization.	Colour, D. S.
JJP Mixed samples of 9 hhds.	94.8 + .3 = 95.1	

No. 681.

Certificate of polarization

Of 1 sample of ref. sugar received on the 17th of Dec., 1885, from S. Barber & Co.

Mark.	Polarization.	Colour, D. S.
HC D	94.6 + .3 = 94.9	

No. 682.

Certificate of polarization

Of 1 sample of ref. sugar received on the 18th of Dec., 1885, from E. McLeod.

Mark.	Polarization.	Colour, D. S.
[C]D 15 bags	93.7 + .3 = 94	

No. 683.

Certificate of polarization

Of 1 sample of muscovado sugar received on the 18th of Dec., 1885, from S. Barber & Co.

Mark.	Polarization.	Colour, D. S.
HB 639	82.1 + .3 = 82.4	

No. 684.

Certificate of polarization

Of 1 sample of ref. sugar received on the 19th of Dec., 1885, from S. Barber & Co.

Mark.	Polarization.	Colour, D. S.
C + J	96.4 + .3 = 96.7	

No. 685.

Certificate of polarization

Of 1 sample of ref. sugar received on the 19th of Dec., 1885, from S. Barber & Co.

Mark.	Polarization.	Colour, D. S.
PC	75.6	

No. 686.

Certificate of polarization

Of 1 sample of ref. sugar received on the 21st of Dec., 1885, from Walter Bagot.

Mark.	Polarization.	Colour, D. S.
No mark	91.1 + .3 = 91.4	

No. 687.

Certificate of polarization

Of one sample of ref. sugar received on the 23rd of Dec., 1885, from Edwin McLeod.

Mark.	Polarization.	Colour, D. S.
[C]D	93.2 = 93.5	

No. 688.

Certificate of polarization

Of one sample of muscovado sugar received on the 24th of Dec., 1885, from S. Barber & Co.

Mark.	Polarization.	Colour, D. S.
HB	82.2 + .3 = 82.5	

640

No. 689.

Certificate of polarization

Of one sample of ref. sugar received on the 29th of Dec., 1885, from S. Barber & Co.

Mark.	Polarization.	Colour, D. S.
XP	96.5 + .3 = 96.8	

No. 690.

Certificate of polarization

Of one sample of ref. sugar received on the 29th of Dec., 1885, from Messrs. S. Barber & Co.

Mark.	Polarization.	Colour, D. S.
B [AV]	97 + .3 = 97.3	

No. 691.

Certificate of polarization

Of 1 sample of ref. sugar received on the 29th of Dec., 1885, from Messrs. S. Barber & Co.

Mark.	Polarization.	Colour, D. S.
M ⋈ B	96.4 + .3 = 96.7	

No. 692.

Certificate of polarization

Of 1 sample of ref. sugar received on the 29th of Dec., 1885, from Messrs. S. Barber & Co.

Mark.	Polarization.	Colour, D. S.
C ⋈ J	95.7 + .3 = 96.00	

No. 693.

Certificate of polarization

Of 1 sample of ref. sugar received on the 30th of Dec., 1885, from S. Barber & Co.

Mark.	Polarization.	Colour, D. S.
S H	92.7 + .3 = 93	

641

No. 694.

Certificate of polarization

Of 1 sample of ref. sugar received on the 30th of Dec., 1885, from Messrs. S. Barber & Co.

Mark.	Polarization.	Colour, D. S.
M + B No. 2	95.7 + .3 = 96	

No. 695.

Certificate of polarization

Of 1 sample of ref. sugar received on the 30th of Dec., 1885, from S. Barber & Co.

Mark.	Polarization.	Colour, D. S.
HC	96.5 + .3 = 96.8	

No. 696.

Certificate of polarization

Of 1 sample of ref. sugar received on the 30th of Dec., 1885, from Edwin McLeod.

Mark.	Polarization.	Colour, D. S.
[C1]	95 + .3 = 95.3	

No. 697.

Certificate of polarization

Of 1 sample of ref. sugar received on the 30th of Dec., 1885, from Edwin McLeod.

Mark.	Polarization.	Colour, D. S.
JJP	92.9 + .3 = 93.2	

No. 698.

Certificate of polarization

Of 1 sample of ref. sugar received on the 2d of Jan., 1886, from S. Barber & Co.

Mark.	Polarization.	Colour, D. S.
[RMJ]H	96.3 + .3 = 96.6	

642

No. 699.

Certificate of polarization

Of 1 sample of ref. sugar received on the 2d of Jan., 1886, from Ferris Grant.

Mark.	Polarization.	Colour, D. S.
JJV 20 hhds.	93.6 + .3 = 93.09	

No. 700.

Certificate of polarization

Of 1 sample of ref. sugar received on the 2d of Jan., 1886, from Edwin McLeod.

Mark.	Polarization.	Colour, D. S.
[H]	94.7 + .3 = 95.	

No. 701.

Certificate of polarization

Of 1 sample of ref. sugar received on the 2d of Jan., 1886, from S. Barber & Co.

Mark.	Polarization.	Colour, D. S.
[F]	94.9 + .3 = 95.2.	

No. 702.

Certificate of polarization

Of one sample of ref. sugar received on the 4th of Jan., 1886, from S. Barber & Co.

Mark.	Polarization.	Colour, D. S.
SH	92.7 + .3 = 93.	

No. 703.

Certificate of polarization

Of 1 sample of ref. sugar received on the 4th of Jan., 1886, from Messrs. S. Barber & Co.

Mark.	Polarization.	Colour, D. S.
[O]	96.4 + .3 = 96.7.	

643

No. 704.

Certificate of polarization

Of 1 sample of ref. sugar received on the 4th of Jan., 1886, from Messrs. S. Barber & Co.

Mark.	Polarization.	Colour, D. S.
J J V	93.5 + .3 = 93.8.	

No. 705.

Certificate of polarization

Of 1 sample of ref. sugar received on the 4th of Jan., 1886, from S. Barber & Co.

Mark.	Polarization.	Colour, D. S.
[F]	95 + .3 = 95.3.	

No. 706.

Certificate of polarization

Of 1 sample of ref. sugar received on the 6th of Jan., 1886, from Edwin McLeod

Mark.	Polarization.	Colour, D. S.
[CI]	95.8 + .3 = 96.1	

No. 707.

Certificate of polarization

Of 1 sample of ref. sugar received on the 6th of Jan., 1886, from Messrs. S. Barber & Co.

Mark.	Polarization.	Colour, D. S.
[B]	95.8 + .3 = 96.1.	

No. 708.

Certificate of polarization

Of 1 sample of ref. sugar received on the 6th of Jan., 1886, from S. Barber & Co.

Mark.	Polarization.	Colour, D. S.
9-E	96.5 + .3 = 96.8.	

644

709.
Jan. 7.
E. McLeod
[C]D 96.6.
Pol.

709.
Jan. 7.
S. Barber & Co.
93.3.
[GV] 18 hhds.

710. S. Barber & Co. (Jan. 7.)
[GV] 2 hhds. 96.7.

711. S. Parker & Co. (Jan. 8th.)
A 95.1.

712. S. Barber & Co. (Jan. 8.)
SH 94.

713. GV X 9 Hhds. 95.9 Jan. 9.
S. Barber & Co.

714. Jan. 9.
GV R 11 Hhds. 96.7.
S. Barber & Co.

715. 11th Jan., 1886.
S. Barber & Co.
94.4.

716. 11th Jan., 1886.
W. Smith.
No. 1. 95.7

717. 11th Jan., 1886.
W. Smith.
No. 2. 95.6

718. 14 Jan.
E. McLeod.
[A]c 96.6.

719. S. Barber & Co. 15 Jan.
[B]

720. 16th Jan.
G. Little & Co.
[H] 94.5

721. 16 Jan., 86.
S. Barber & Co.
GV 95.8.

722. 16 Jan., 86.
Hon. A. Barr.
[RMJ]H 96.6.
645

723. Sandbach, Parker & Co. 16 Jan., 86.
RX

724. 16 Jan., 86.
Hon. A. Barr.
P 96.3.

725. S. Barber & Co. 18 Jan.
CXJ 96.2.

EXHIBIT F.

Suit No. 2918, &c.

Bartram *v.* U. S.

Ex. F, Feb. 1, 1900.

THE JOURNAL

OF

THE ROYAL AGRICULTURAL AND COMMERCIAL SOCIETY OF BRITISH GUIANA.

Vol. IX, new series. December, 1895. Part II.
Edited by James Rodway, F. L. S.

Meeting held December 19th.—Hon. E. C. Luard, p-esident in the chair.

Members preser t 25.

Election.—Members: Revd. L. Crookall and Mr. Lloyd Dornford.

Associates: Messrs. C. H. Bagot, W. Cunningham, Jnr., M. H. Bugle, R. A. Reynolds, W. H. McGowan and R. Belgrave.

Communications were read from Messrs. J. R. Bovell and J. H. Hart thanking the society for electing them honorary members, and J. E. Deurden for loan of Indian curios from the museum.

The Hon. B. Howell Jones brought forward a paper by Prof. Harrison which had been read before the meeting of the society of October, 1894, and laid over. It had been recommended for adoption by the society as their official standard method of polarisation of sugar, and Mr. Jones moved that it be now adopted:—

It is well-know- that the polariscopes of the Soleil Duboscq, of the Soleil-Scheibler-Ventke, of the Schmidt & Haensch shadow, and of the Laurent ordinary light construction, when used at tropical temperatures with solutions made by dissolving the makers' normal weights of chemically pure sucrose to a bulk of one hundred
646 cubic centimeters, never, if correctly adjusted by the makers at a normal temperature of 17.5 deg. C. (63.5 deg. F.), give readings of 100 deg., but readings varying from 99.6 to 99.78. That is, that working with these instruments in the exact manner laid down by their makers, but at temperatures of about 80 deg. F. instead of about 60 deg. F., the instruments show from .3 to .4 of one per cent. less than the true sugar polarisations. In consequence, a sugar which polarises 96 deg. when examined at the normal temperature for which the instruments are constructed, will, if normal weights are made up to normal volumes at our prevailing temperature (temperature being the only factor varying) polarise only about

95.7. These instruments all show the sugar percentages by means of quartz plate compensators.

Instruments using monochromatic light (light from a flame coloured by codium) and in which the readings are obtained by rotation of the analyser, the readings of a sugar showing 100 deg. when tested at 63.5 deg. F. give only 99.85 at 86 deg. These errors arise from two causes:—

1st. The rota-ry power of quartz for light increases with the temperature, thus requiring a greater weight of sugar to produce a definite degree of rotation at high temperatures than at low ones.

2nd. The rotatory power of sucrose solution decreases slightly by rise of temperature (irrespective of changes of volume), and this has the same effect upon the polariscope indications.

In addition to these which are the primary causes of error, some instruments are furnished with metal scales which by their expansion add very slightly to them.

The effects of these errors can easily be calculated, but owing to the fact that the rotatory power of quartz is not absolute- invariable in different specimens, it is far preferable to standardise the polariscopes under the exact conditions in which they are to be used, than to apply calculated corrections.

(I may here mention that I believe that the Laurent instruments are standardised by the marker at 4 deg. C. (39.2 F.) and in consequence the errors arising from using the normal weight of 16.2 grams at our temperatures become very marked.)

It has been my practice, whilst I have been in the West Indies, to standardise all the measuring instruments used to true cubic centimetres, and to set the polariscope by ascertaining either the necessary corrections or the true normal weight by the use of solutions of chemically pure sugar. The late Mr. Francis invariably used the same method, and it is that used by certain of the more highly qualified technical chemist in this colony.

Recently some polarisations have been made here using the normal weight for a Ventzke instrument at 63.5 deg. F. and a flask containing 100 Mohr cubic centimetres *i. e.* 100 grams of water at 30 C. (86 deg. F.) instead of holding 100 true cubic centimetres, this resulting in sugars so polarised showing .6 of one per cent. lower than duplicate samples examined by the government analysts.

647 As a result of this, I have been informed by one of the leading firms of sugar exporters that "under your system the purchaser here must necessarily be the loser." As a matter of fact the system adopted at the government laboratory is the only one by which samples of the same sugar examined in different instruments, by different observers and at varying temperatures, could give identical results, and, as a necessary consequence, it must be absolutely fair to both buyer and seller. When the normal weight of 26.048 grams is taken and made up to 100 cubic centimetres and examined at our temperature, in a Schmidt & Haensch instrument correctly adjusted at 17.5 deg. C., then the result is that the seller is the loser to the extent of .35 of one per cent.; whilst if the solution is made up to the volume occupied by 100 grams of water at

the temperature prevailing here, he will be the loser to the extent of rather more than .6 of one per cent.

The point upon which I consider that it is desirable for the Planters' Association to express an opinion and definitely settle with regard to the basis upon which sugar tests are to be made here is:—

Does a polarisation of 96 deg. mean that a sugar indicates that 96 deg. in the polariscope when tested in such a manner that a sugar containing 100% of sucrose will indicate 100 deg.?

Or does it mean that it is merely a reading of 96 deg. when sugar is tested by dissolving the maker's normal weight for the instrument used to 100 c. c. in which case results varying from 95.2 to 95.9 may be obtained by examining a sugar correctly polarising 96 by means of the various instruments at present in the colony which have come under my observation?

Or are you willing to accept a further deduction from the true polarisation of .3 of one per cent. by the use of flasks holding 100 grams of water at 86 deg. F. instead of 100 true cubic centimetres?

In other words is the standard to be 96 as it has been up to the present, or a varying one of from 96.1 to 96.8 according to the instrument used, or, still more objectionable, of from 96.4 to 9.71 when in addition to the instrumental errors, a flask graduated on a wrong system is used.

This should be definitely settled, and all chemists polarising sugars here for commercial purposes de required to examine the samples submitted to them in accordance with the method adopted by your association.

As an illustration of the varying results which may be obtained by examining sugars by different instruments, using in each case the normal weight for a temperature of 63.5 deg. F., I may mention the following obtained in the government laboratory with a sugar testing correctly 96 and using the various instruments in my possession.

648

Instrument used.	Normal weights taken.	Result.
Soleil Ventzke Scheibler (instrument used by Mr. Francis)	26.048 grams.	95.7
Schmidt and Haensch (specially corrected instrument made for the gov't laboratory)	" "	95.88
Schmidt and Haensch (not corrected)	"	95.65
Laurent sodium light	16.3	95.9
Laurent white light	"	95.6

At the present time the errors incidental to the use of polariscopes at temperatures other than the standard for which they are originally constructed, are fully recognized in the United States, and a special system of correction is in use in the custom house laboratory, and was also employed in the laboratory in which the bounty was assessed. Each instrument used is supplied with a set of stand-

ard quarter plates, and with tables shewing the sugar value of each of them, (in terms of Ventzké degrees) at various temperatures. The instruments when used are set by one of these plates, and a correction applied to the reading corresponding to the recorded value of the quartz plate used at the temperature of observation.

Thus in the case of sugar polarising about 96 deg. the instrument would be set by means of a quarter plate having a value of about 96 deg., say in this case of 96.5, at 17.5 deg. C. The temperature, for example is found to be 28 deg. C., by reference to the table the sugar value of the quartz plate is seen to be 96.8, an addition of 3 is then made to the observed readings of all polarisations of sugars approximating to 96 deg. examined at the same temperature and at the same time.

I have been informed that such a cause is not recognized in Germany. Possibly this may be, *to* as during the sugar making season the temperature will not be at any time much above the standard of 17.5 deg. C. At the same time as such authorities as Landelt specially draw attention to the variation in the rotatory power of quartz, caused by changes in temperature and give corrections to be applied to the polarisations of sugar solutions for such changes, I feel certain that when accuracy is desired these temperature effects are fully recognized and allowed for.

As the range of temperature here is not very great, I consider that the method used in the government laboratory for the last fourteen years is the best. Each 100 cubic centimeter flask in use for sugar polarisations is verified by weighing into it 99.533 grams of recently boiled distilled water at 28 deg. C. The exact weight of chemically pure sugar, which when made up to a bulk of 100 cubic centimeters in one of the corrected flasks at 28 deg. C. gives a polarisation reading of 100 deg. is ascertained by experiment for each instrument and this weight of sugar is invariably used instead of the makers' normal weight for 17.5 deg. C.

Mr. R. G. Duncan seconded, at the same time asking that it should be brought up again at the next meeting, after republication. This was agreed to.

Exhibit G, Suit No. 2918.

	Plate readings				Sugar Readings						
1899	*T.*	*B.*	*C.*								
Nov. 8	100.44	100.39	100.42	100.42	*Soln.*	*T.*	*B.*	*C.*		*Temp.*	
					No.1 C	99.84	99.84	99.84 =	99.84	20.0	23.0 = 21.50
					2B	72	85	78 =	78	+ 21.0	23.3 = 22.15
Nov. 10	43	48	45 =	45	3C	78	82	80 =	80	19.5	22 7 = 21.1
					4B	78	80	76 =	78	19.0	25.0 = 22.0
Nov. 20	51	47	46 =	48	20C	100.11	100.02	100.04 =	100.06 =	16.7	18.3 = 17.5
					21T		99.86	99.91 =	99.88[2]	16.5	18.0 = 17.25
					22B		.99	100.04 =	100.01[2]	17.2	20.0 = 18.6
					23C		.88	99.87 =	99.87[2]	17.2	18.7 = 17.95
					24B	.02	100.05	.99 =	100.02	18.1	19.0 = 18.55
					25C		99.83	.86 =	99.84[2]	17.5	21.7 = 19.6
Nov. 21	49	48	49 =	49	26C		100.05	100.08 =	100.06[2]	15.7	18.2 = 16.95
					27B	.04	.05	=	.04[2]	15.0	17.8 = 16.4
					28C		99.96	99.94 =	99.95	17.3	19.5 = 18.4
					29B		.90	.95 =	.92[2]	17.7	20.1 = 18.9
					30C		.97	100.01 =	.99	17.8	20.8 = 19.3
Means	100.467	.455	.455 =	459		99.899	99.925	99.916 =	9.25	17.747	19.076

Low Temp.

	T	*B*	*C*	
Plate reads	100.467	.455	.455 =	.459
" value	100.36	.36	.36 =	.36
Just. too high	05.07	.095	.095 =	.099
Sugar reads	99.899	.925	.916 =	.925 at 19° .076 C
Corrected sugar reading	99.792	.830	.821 =	.826 " "

High Temp.

	Plate readings					Sugar readings						
1899	*T.*	*B.*	*C.*		*Soln.*	*T.*	*B.*	*C.*			*Temp.*	
Nov. 13	100.50	.57	.54	= .54	5	99.74	.69	.74	=99.72+	27.5	28.0=	27.75
					6	82	.72	.73	.76—	28.0	29.8=	28.9
Nov. 15	.52	.40	.43	= .45	7	69	.60	.63	.64	27.5	——	28.5?
	.54	.53	.48	= .52—	8	.62	.64	.48	.58	27.0	29.0	28.0
					9	.67	.73	.71	.70+	27.5	29.0	28.25
					10	.72	.75	.74	.74—	27.5	28.3	27.9
					11	.77	.71	.72	.73+	27.3	30.0	28.65
					12	.62	.75	.54	.64—	27.4	29.8	28.6
					13	.83	.78	.74	.78+	27.5	29.5	28.5
Nov. 16	.50	.50	.44	= .48	14	.52	.50	.62	.55—	26.5	30.3	28.4
	.50	.51	.47	= .49+	15	.56	.58	.53	.56—	27.2	30.7	28.95
					16	.60	.62	.60	.61—	29.0	30.7	29.85
					17	.52	.57	.53	.54	29.3	31.0	30.15
					18	.50	.62	.59	.57	29.3	31.0	30.15
					19	.68	.70	.64	.67+	29.3	31.3	30.3
Means.	100.512	.502	.472—	.496		99.657	6.64	6.36	6.53—	27.853		28.857

	T.	*B.*	*C.*			
Plate reads	100.512	.502	.472	= .496		
" value	100.36	.36	.36	= .36		
Just. too high	0.152	.142	.112	= .136		
Sugar reads	99.557	.664	.636	.653	at 28°	.857 C
Corrected sugar reading	99.505	.522	.524	= .517	"	"

	Mean Temp.	*T.*	*B.*	*C.*	*Mean*
Corrected sugar reading at	19.°076—	99.792	.830	.821—	.826
" " " "	28.857 =	99.505	.522	.524	.517
Diffs.	9.781 =	0.287	.308	.297—	.309
Temp. Coefficient		0.029+	0.031+	0.030+	=0.030+
Using first temps. only " =		0.028+	0.030+	0.029+	=0.030+

651.

Exhibit H. for Govt.

Suits 2918, 2919 and 2920.
Bartram Bros. v. U. S.,
and two other suits.

Troisiéme Rèunion
de la
Commission Internationale d'unification des méthodes d'analyse du sucre.

La troisiéme rèunion de la Commission internationale d'unification des méthodes d'analyse du sucre a eu lieu á Paris, le 24 juiliet 1900, dans la grande salle de rèunion du Syndicat des fabricants de sucre de France.

Proceedings of the Third Session
of the
International Commission for Uniform methods of sugar analysis,
held in Paris July 24, 1900,
in the large salon of the Chambre Syndicyle des fabricants de sucre de France.

Dritte Versammlung
der
Internationalen Commission für einheitliche Methoden der Zuckeruntersuchungen.
Die Versammlung wurde in Paris am 24. Juli 1900 im grossen Saal des Syndicats der französischen Zuckerfabrikanten, abgehalten.

Etaient présents:
There were present:
Anwesend die Herren:

Herr Professor Dr. A. Herzfeld als Vorsitzender;
" Professor Dr. Brodhun, Delegirter der phys. techn. Reichsanstalt zu Berlin;
" Dr. Von Buchka, Regierungsrath, Delegirter des Kaiserlichen Reichsgesundheitsamtes zu Berlin;
" Camuset, président de la Commission technique du Syndicat des fabricants de sucre de France;
" Dr. Herrman, Mitinhaber des Laboratoriums Dr. Alberti & Hempel, Hamburg;
" François Herles, Handelschemiker zu Prag;
" A. Jobin, Paris;
" François Sachs, délégué de l'Association des fabricants de sucre de Belge;
" Saillard, professeur, délégué du Syndicat des fabricants de sucre de France;
" Regierungsrath Strohmer, Delegirter des Vereins für die Rübenzuckerindustrie in Oesterreich-Ungarn;
" van Voss, Versitzender des Vereins der holländischen Zuckerfabrikanten;
" Dr. Otto Wendel, Mitinhaber des Laboratoriums von Dr. Hugo Schulz Magdeburg;
" Dr. F. G. Wiechmann, New-York, chemist representative of the American Sugar Refining Co.;
" Dr. H. W. Wiley, chief chemist of the Department of Agriculture, Washington, D. C.;
" Dr. Heinrich Winter Java.

S'étaint excusés: Excused were Mess: Entschuldigt die Herren:

Bunge, Kiew; van Ekenstein, Amsterdam; Nevolé, Prag; Dupont, Paris.

Le Président ouvre la séance en souhaitant la bienvenue à tous les membres présents.

Il remercie ensuite la Chambre syndicate des fabricants de sucre d'avoir bien voulu mettre sa grande salle de réunion à la disposition de la Commission et d'avoir désigné un nouveau délégué, M. Camusêt, pour assister aux délibérations. Il prie en même temps MM. Saillard et Wiechmann de vouloir bien rédiger en français et en anglais le procès-verbal de la réunion présente.

Le Président rapelle d'abord comment la Commission a pris naissance et quels travaux elle a effectués jusqu'ici.

Il fait remarquer que le litre métrique ayant été substitué au litre Mohr, dans certains pays, il convient de fixer le nouveau poids normal des appareils allemands. Dans une note du 19 octobre 1898, l'Institut physique et technique allemand, conclut que le poids du sucre pur et sec qui. porté à 100 c. c. métriques, à la température de 20° C, donne le point 100 de l'échelle allemande, est représenté par 26 gr. 01 (et non 26 gr.) pesés dans l'air, avec des poids de laiton.

En égard à la faible différence (26 gr. au lieu de 26 gr. 01) la commission déclare qu'il y a lieu de prendre comme poids normal nouveau 26 gr. de sucre pur et sec pesés dans l'air avec des poids de laiton. On les complètera à 100 c. c. métriques, à la température de 20°.

M. Willey (Etat-Unis) donne connaissance des résultats qu'il a

The Chairman opened the session on July 26, 1900 in the large hall of the Chambre Syndicale des Fabricants de Sucre de France, welcomed those present and expressed special thanks to the Chambre Syndicale des Fabricants de Sucre de France for the hospitable reception as well as for having delegated Mons. Camuset to the meeting of the Commission.

After the Chairman had given a short resumé of the origin as well as the prior work of the Commission, he addressed the request to Mess. Saillard and Wiechmann to again undertake the editing of the French and the English text of the proceedings, which both gentlemen willingly agreed to do.

Referring to the prior written communication, the Chairman then once more put before the Commission the question, which normal weight should be valid for the German instruments, when using the metric flask. As is well known, the Imperial Physical-Technical Institute has called attention, by its communication dated Oct. 19, 1898, to the fact, that an exact conversion of the normal weight 25,048 g for Mohr's cubic centimetres, at 17,5° C., corresponds to 26,01 g (not 26,00), metric volume, at 20° C, determined in air, with brass weights.

"The Commission decides, that, in consideration of the insignificance of the deviation, the normal weight of 26,00 g shall henceforth be adopted for 100 metric cubic centimetres, at 20° C., de-

Der Vorsitzende eröffnete die Zusammenkunft am 24, Juli d. J. im grossen Saale der Chambre syndicale des fabricants de sucre de France, hiess die Anwesenden willkommen und dankte insbesondere der Chambre syndicale des fabricants de sucre für die gastfreundliche Aufnahme, sowie dafür, dass dieselbe Herrn Camuset zu den Verhandlungen delegirt hat.

Nachdem der Vorsitzende ein kurzes Resumé über den Ursprung sowie die bisherigen Arbeiten der Commission gegeben hatte, richtete derselbe an Herrn Saillard und Herrn Wiechmann die Bitte, wiederum die Redaction des französischen und englischen Textes des Protokolls übernehmen zu wollen, was beide Herren freundlichs zusagen.

Der Vorsitzende legt sodann mit Bezugnahme auf die vorangegangene schriftliche Mittheilung der Commission nochmals die Frage vor, welches Normalgewicht für die deutschen Apparate bei metrischen Kolben gelten solle. Bekanntlich hat die physikalisch-technische Reichsanstalt durch Schreiben vom 19. October 1898 darauf aufmerksam gemacht, dass die genaue Umrechnung des Normalgewichts 26,048 g für Mohrsche Cubikcentimeter bei 17,5° auf metrisches Volumen bei 20° an der Luft und mit Messinggewichten 26,01 (nicht 26,000) ergiebt.

„Die Commission beschliesst, dass in Anbetracht der Geringfügigkeit der Abweichung, für metrische 100 ccm bei 20° an der Luft mit Messinggewichten be-

obtenus en étudiant l'influence de la température sur la polarisation du sucre (son travail sera publié).

M. Wiechmann parle ensuite de l'influence de la température sur le pouvoir rotatoire spécifique du sucre. Il présente un extrait de son travail qui a été publié dans la *Zeitschrift des Vereins der Deutschen Zucker-Industrie.*

Dans la discussion qui s'engage ensuite, M. le Professeur Brodhun dissipe quelques malentendus qui s'étaient introduits dans l'esprit de quelques-uns des membres présents au sujet des deux travaux précédents et aussi au sujet des études publiées, sur le même objet, par l'Institut physique et technique de Berlin.

M. Pellat, professeur à la Sorbonne (Paris), n'ayant pu assister à la séance, la Commission décide qu'elle entendra sa communication au Congrès international de chimie appliquée (section de sucrerie).

M. Jobin (Paris) déclare qu'il n'a effectué aucun essai personnel pour déterminer l'influence de la température sur les saccharimètres: il rapelle simplement les publications qu'il a faites antérieurement sur cette question et se rallie, pour conclure, au travail de M. Pellat.

Il montre enfin les causes d'erreurs qui sont imputables aux saccharimètres à compensateurs et une longue discussion s'engage à ce sujet.

M. le professeur Herzfeld communique les résultats qu'ont donnés les essais sur les plaques de quartz. Un rapport détaillé sera publié à ce sujet.

termined in air with brass weights."

Mr. Wiley then spoke of the results of his researches concerning the influence of temperature on the polarization of sugar; this is printed in the appendix.

This was followed by a communication by Mr. Wiechmann of New York concerning the influence of temperature on the specific rotation of sugar, an abstract of his publication appearing in the *Zeitschrift des Vereins der Deutschen Zucker-Industrie.*

A long discussion bearing on the substance of the two lectures followed, in which Professor Dr. Brodhun removed some wrong conceptions which some of those present had entertained concerning the experimental basis of the lectures, and especially concerning the researches which the Imperial Physical-Technical Institute at Berlin, had made on the same subject.

Mr. Pellat was unable to be present on the day of the session; the Commission therefore agreed to be present at his lecture, Friday, July 27, 1900, in the session of Section V of the Congress for Applied Chemistry, as Mr. Pellat intended to give his lecture on the day and at the place named.

Mr. Jobin reported that he himself had not made personal investigations ragarding the influence of temperature on polariscopic instruments, he referred solely to his earlier publication on this subject as well as to the coming lecture of Mr. Pellat. Mr. Jobin discussed

stimmt Künftighin das Normalgewicht 26,00 angenommen werden soll."

Darauf hält Herr Wiley einen Vortrag über die Resultate seiner Untersuchungen betreffend den Einfluss der Temperatur auf die Polarisation des Zuckers, welcher in der Vereinszeitschrift abgedruckt ist.

Es folgte die Mittheilung des Herrn F. Wiechmann, New-York, über den Einfluss der Temperatur auf die specifische Drehung des Zuckers, welcher gleichfalls in der Zeitschrift des Vereins der deutschen Zucker-Industrie erschienen ist.

Es entspann sich über den Inhalt der beiden Vorträge eine lange Erörterung, in welcher besonders auch Herr Prof. Dr. Brodhun eine Reihe von missverständlichen Auffassungen beseitigte, welche einzelne der Anwesenden bezüglich der experimentellen Grundlagen der Vorträge, sowie insbesondere auch der Arbeiten der physikalisch-technischen Reichsanstalt zu Berlin über das gleiche Thema gehegt hatten.

Herr Pellat war am Sitzungstage verhindert, die Commission stimmt daher zu, seinem Vortrage am Freitag, den 27. Juli in der Sitzung der Section V des Congresses für angewandte Chemie beizuwohnen, da Herr Pellat am genannten Tage und Orte den Vortrag zu halten beabsichtigt.

Herr Jobin theilt mit, dass er selbst persönlich Untersuchungen über den Einfluss der Temperatur auf die Polarisationsapparate nicht angestellt habe, er bezieht

La Commission décide que ces plaques seront réparties entre les différents pays qui sont représentés à la Commission.

Elles seront déposées: aux Etats-Unis, dans le laboratoire du ministère de l'Agriculture; en France, au Syndicat des fabricants de sucre; en Belgique, en Hollande, en Autriche-Hongrie, en Russie, aux Sociétés de fabricants de sucre qui ont envoyé des délégués.

La séance est levée à midi; elle est reprise le même jour, à 2 heures.

Seance de l'apres-midi.

M. Strohmer, conseiller de gouvernement montre, dans sa communication, l'intérêt que présente l'unification des méthodes d'analyse du sucre pour le commerce international et soumet aux collaborateurs de la Commission les décisions qui ont été prises par l'assemblée générale des chimistes d'Autriche Hongrie, tenue à Buda Pesth, le 22 juin 1896.

L'assembée estime qu'il y a lieu de fixer d'abord les conditions dans lesquelles doit être effectuée la graduation des saccharimètres.

Sur la proposition de MM. Camuset et Saillard, la résolution suivante a été acceptée à l'unanimité:

La Commission déclare choisir comme base de la saccharimétrie la rotation du sucre chimiquement pur. Ce sucre sera préparé partout suivant la même méthode (méthode anglaise) qui est la suivante:

the errors with which instruments provided with quartz-wedge compensations are burdened; this gave rise to a longer discussion..

Then Prof. Dr. Herzfeld made a brief report on the results of the examinations of quartz plates, concerning which a full report will be found in the appendix. The Commission agrees that these quartz-plates shall be divided among the nations represented; for the United States, the plates are to be sent to the Department of Agriculture at Washington; for France to the Syndicate of the sugar-manufacturers; for Belgium, Holland, Austria-Hungary, and Russia, to the associations of sugar-manufacturers which are represented in the session by delegates.

The session was then adjourned for lunch and reopened at 2 o'clock in the afternoon of the same day.

Afternoon Session.

Mr. Regierungsrath Strohmer delivered his lecture on a uniform method of sugar-analysis for International trade, and submitted, as a basis for the same, the agreement which the Austria-Hungarian Chemists had last reached in their Convention, June 22, 1896, at Budapest. Mister Strohmer proposed to accept these regulations, with certain deviations, as a basis of the International agreement, and suggested for this purpose the separate discussion of the different topics. The Convention agreed to do this, but first of all considered it necessary to establish general principles for

sich lediglich auf seine frühere Publication über den Gegenstand, sowie den noch ausstehenden Vortrag des Herrn Pellat. Herr Jobin bespricht die Fehler mit denen die Apparate mit Quarzkeilcompensationen behaftet sind, woran sich eine lange Erörteruug knüpfte.

Darauf trägt Prof. Dr. Herzfeld das Ergebniss der Prüfung von Quarzplatten vor, worüber in der Vereinszeitschrift, technischer Theil, ein ausführlicher Bericht erschienen ist. Die Commission stimmt zu, dass diese Quarzplatten unter die vertretenen Nationen vertheilt werden und zwar sollen für die Vereinigten Staaten die Quarzplatten dem Department of Agriculture in Washington, für Frankreich, dem Syndikat der Zuckerfabrikanten, für Belgien, Holland, Oesterreich-Ungarn und Russland den Vereinigungen der Zuckerfabrikanten, welche in der Commission durch Delegirte vertreten sind, überwiesen werden.

Die Sitzung wurde darauf zur Mittagszeit abgebrochen und am gleichen Tage Nachmittags, 2 Uhr wieder aufgenommen.

Nachmittagssitzung.

Herr Regierungsrath Strohmer hielt einen Vortrag über die einheitliche Gestaltung der Zuckeranalyse für den internationalen Handel und legte demselben die Vereinbarungen zu Grunde, welche die österr.-ungarischen Chemiker zuletzt in ihrer Versammlung am 22. Juni 1896 zu Budapest getroffen haben. Herr Strohmer

Préparer à chaud une solution de sucre saturée: précipiter le sucre avec de l'alcool éthylique absolu; turbiner le tout au moyen d'une petite centrifuge et laver le sucre retenu avec un peu d'alcool. Redissoudre dans de l'eau chaude et jusqu'à saturation, le sucre obtenu, précipiter à nouveau avec de l'alcool; turbiner et laver comme précédemment.

Sécher le sucre entre des feuilles de papier buvard et le conserver en flacons bouchés.

L'humidité restante est déterminée par pesée et portée en compte au moment où l'on a à préparer la solution sucrée.

La Commission décide, en outre, que dans chaque pays une institution sera chargée de la préparation et de la distribution de ce sucre pur. Dans les cas où ces dernières dispositions ne pourraient être appliquées, les saccharimètres seront contrôlés avec des lames de quartz dont le pouvoir rotatoire, exprimé en sucre, aura été déterminé avec du sucre chimiquement pur.

Dans la discussion qui s'est produite à ce sujet, on a fait remarquer, d'une part, que la préparation du sucre chimiquement pur n'est pas du tout chose facile et, d'autre part, que dans les pays qui jouissent d'un climat chaud le sucre sera difficile à conserver avant l'emploi et pourra donner lieu à des erreurs.

C'est pourquoi la Commission a décidé que le contrôle des saccharimètres par le sucre n'aurait lieu que dans les Institutions ci dessus mentionnées; partout

the adjustment of polariscopic instruments, as well as for the avvidence of errors caused by the influence of temperature.

On motion of Mess. Camuset and Saillard, first of all, the following was adopted:

"The Convention declares it to be necessary that the rotation of chemically pure sugar be accepted as the fundamental basis in saccharimetry.

The chemically pure sugar which is to be employed for this purpose shall everywhere be prepared according to the same method, which is as follows (method of the English chemists):

Purest commercial sugar is to be further purified in the following manner: A hot saturated aqueous solution is prepared and the sugar precipitated with absolute ethyl alcohol; the sugar is carefully spun in a small centrifugal machine and washed in the latter with some alcohol. The sugar thus obtained is re-dissolved in water, again the saturated solution is precipitated with alcohol and washed as above. The product of the second centrifugating is dried between blotting paper and preserved in glass vessels for use. The moisture still contained in the sugar is determined and taken into account when weighing the sugar which is to be used."

The Convention furthermore decides that central stations shall be designated in each country which are to be charged with the preparation and the distribution of chemically pure sugar. Wherever this arrangement is not feasible, quartzplates, the values

schlug vor, diese Vereinbarungen mit einzelnen Abweichungen als Grundlage für die internationalen Vereinbarungen anzunehmen und zu diesem Behufe die einzelnen Punkte gesondert durchzuberathen. Die Versammlung stimmte dem zu, erachtete es jedoch für nothwendig, zunächst allgemeine Grundsätze für die Justirung der Polarisationsapparate, sowie behufs Vermeidung von Fehlern durch die Temperatureinflüsse aufzustellen.

Auf Antrag der Herren Camuset und Saillard wurde zunächst folgendes beschlossen:

„Die Versammlung erklärt es für nothwendig, daas als Grundlage für die Saccharimetrie die Drehung des chemisch reinen Zuckers genommen wird.

Der chemisch reine Zucker, welcher zu diesem Behufe benutzt wird, soll überall nach der gleichen Methode bereitet werden, welche folgendermaassen lautet: „Methode der englischen Chemiker"

„Reinster käuflicher Zucker wird in folgender Weise weiter gereinigt: Man stellt sich eine heiss gesättigte wässrige Lösung her und fällt den Zucker mit absolutem Aethylalkohol, schleudert den Zucker in einer kleinen Centrifuge sorgfältig ab und wäscht ihn in derselben mit etwas Alkohol nach. Der so gewonnene Zucker wird wieder bis zur Sättigung in Wasser gelöst, mit Alkohol gefällt, abgeschleudert und wie oben nachgewaschen. Das Product der zweiten Schleuderung

ailleurs et en particulier dans les laboratoires du commerce, il sera effectué au moyen de lames de quartz, verifiées avec du sucre pur.

En ce qui concerne la température à laquelle les observations doivent être faites, la Commission adopte unanimement la température de 20° proposée par M. Sachs.

La vérification des saccharimétres doit donc être faite de la manière suivante:

On dissout, dans un ballon de 100 c. c. métriques, le poids normal de sucre pur et sec (26 gr. pour les appareils allemands) pesés à l'air avec des poids en laiton et on polarise la solution dans une salle dont la température est également 20°. La lecture doit donner exactement 100. Pour toutes les solutions sucrées à analyser, la température sera toujours ramenée à 20° pendant la dissolution et durant la polarisation.

Toutefois, pour les pays dont la température est en général plus élevée, on admettra que le polarimètre soit gradué à 30° on encore à une autre température convenable; mais les solutions sucrées à analyser devront être préparées et polarisées à cette même température.

Au sujet de la fixation d'un poids normal unique, MM. Sachs et Strohmer élèvent des objections contre le chiffre de 20 gr.

La Commission décide donc qu'elle laissera la question en suspens; elle émet toutefois le voeu qu'un poids normal unique soit adopté pour tous les pays.

of which have been determined by means of chemically pure sugar, shall serve for the control of the saccharimeters.

Mention should be made of the fact that in the discussion on this topic, it was remarked, on the one hand, that the preparation of chemically pure sugar is not an easy task, and that in countries having hot climates, sugar is dried with diffuilty and hence is not stable, and hardly available for transportation. Thereupon it was pointed out that the above control, by means of chemically pure sugar, should, as a rule, apply only to the central stations which are to test the correctness of saccharimeters; for those who execute commercial analyses, the repeated control of the instruments is to be accomplished, now as before, by means of quartz-plates.

Concerning the working-temperature the following resolution of Mr. Francois Sachs was unanimously adopted:

„In general, all sugar tests shall be made at 20° C.

The adjustment of the saccharimeter shall be made at 20° C. One dissolves (for instruments arranged for the German normal weight) 26 g of pure sugar in a 100 metric cubic centimeters flask*), weighting to be made in air, with brass weights, and polarizes the solution in a room the temperature of which is also 20° C. Under these conditions the instrument must indicate exactly 100,00.

*) or, during the period of transition, 26,048 g in 100 Mohr's cubic centimeters.

wird zwischen Fliesspapier getrocknet und in Glasgefässen für den Gebrauch aufbewahrt. Die im Zucker noch enthaltene Feuchtigkeit wird ermittelt und beim Abwiegen des bei der Benutzung aufzulösenden Zuckers in Anrechnung gebracht."

Die Versammlung beschliesst fernerhin, dass Centralstellen in jedem Lande bezeichnet werden sollen, welche die Bereitung und Versendung des chemisch reinen Zuckers zu übernehmen haben. Da wo diese Einrichtung nicht ausführbar ist, sollen Quarzplatten, deren Werth mittelst chemisch reinen Zuckers ermittelt ist, zur Controlle der Saccharimeter dienen.

Aus der Debatte über diesen Gegenstand ist hervorzuheben, dass einerseits betont wurde, das bekanntlich die Bereitung chemisch reinen Zuckers einegar nicht leichte Aufgabe sei, andererseits in Ländern mit heissem Klima der Zucker schwer zu trocknen und deshalb wenig haltbar und kaum versendbar sei. Demgegenüber wurde hervorgehoben, dass obige Controlle durch chemisch reinen Zucker in der Regel nur für die Centralstellen zu gelten habe, welche die Richtigkeit der Saccharimeter zu prüfen haben. Für diejenigen, welche Handelsanalysen ausführen, wird die wiederholte Controlle der Instrumente nach wie vor mit Quarzplatten vorzunehmen sein.

Bezüglich der Arbeitstemperatur wird einstimmig folgende

L'assemblée, discutant les propositions de M. Strohmer, prend les résolutions suivantes:

I. Polarisation.

La polarisation sera faite au moyen de saccharimètres à prénombre. L'appareil sera placé toujours dans la même position et à une distance assez grande de la source de lumière pour que le nicol polariseur ne puisse, par rayonnement, subir une élévation de température.

Il est à recommander d'employer comme sources lumineuses des lampes à forte intensité: lampe triplex au gaz avec cylindres métallique, lentille et réflecteur: flamme de gaz avec bec Auer, lampe électrique, lampe Duplex au pétrole; flamme de gaz salée.

Avant toute analyse, l'opérateur doit contrôler le poids, les ballons jaugés, les tubes de polarisation, les obturateurs en verre (exclure de l'emploi les obturateurs qui présent ent des parties écaillés).

Il doit aussi, avant et après les observations, s'assurer et de l'exactitude de l'appareil au moyen de lames de quartz contrôlées, et de la constance de la lumière.

A chaque détermination, on fait plusieurs lectures: on établit ensuite la moyenne des résultats obtenus, sans enclure aucun.

II. Analyse du sucre.

1. Dosage de la saccharose: Prendre le poids normal ou plusieurs

The temperature of all sugar solutions to be tested is always to be kept at 20°C, while they are being prepared and while they are being polarized.

However, for those countries the temperature of which is generally higher, it is permissible that the saccharimeters be adjusted at 30°C. (or at any other suitable temperature), under the conditions specified above, and providing that the analysis of sugar be made at that same temperature."

Objections were raised against the universal normal weight 20,00 g, by Mr. François Sachs as well as by Mr. Strohmer. In consequence, it was resolved not to undertake the introduction of the same, but to adopt the resolution:

The general International introduction of a uniform normal weight is desirable.

It was furthermore resolved, on the basis of the proposition of Mr. Strohmer, to observe the following rules in raw sugar analysis.

I. Polarization.

„In effecting the polarization of substances containing sugar, half-shade instruments only are to be employed.

During the observation the apparatus must be in a fixed, unchangeable position and so far removed from the source of light that the polarizing Nichol is not warmed by the same.

As source of light there are to be recommended lamps with in-

Resolution des Herrn Francois Sachs angenommen:*)

„Im Allgemeinen sollen alle Zuckeruntersuchungen bei 20° vergenommen werden.

Die Justirung der Polarimeter bei 20°erfolgen. Man löst (für die Apparate mit deutschem Normalgewicht) 26 g reinen Zucker**) in einem Kolben von 100 metrischen Cubikcentimetern an der Luft mit Messinggewichten gewogen und polarisirt die Lösung in einem Raume, dessen Temperatur 20°beträgh. In diesem Falle muss der Apparat genau 100,00 anzeigen.

Zu untersuchende Zuckerlosungen sind stets auf der Temperatur 20° C.

*) Anmerkung. Im Urtext lautet die Resolution folgendermassen:

En regle generale toutes les analyses de sucre doivent etre faites a 20°C.

La verification du polarimetre doit se faire a 20°C. C'est-a-dire on dissout (pour les appareils au poids normal allemand) 26 grammes (pendent l'epoque de transition 26,048 g de sucre d'apres la graduation de Mohr) de sucre pour dans un ballon de 100 cm, volume metrique ans l'air (poids de cuivre jaune) et on polarise la solution dans une salle dont la temperature est egalement a 20°C. Dans ce cas le polarimetre doit accuser 100°. Pour toutes les solutions de sucre a analyser, la temperature sera toujours ramenee, pendant la dissolution et durant la polarisation, a 20°C.

Toutefois, pour le pays dont la temperature est en general, p .s eleve ou admettra que le polarimetre soit gradue a 30 C, (on a une autre temperature convenable) dans les conditions indiquees cidessus et que les analyses de sucre s'effectuent a la meme temperature.

**) oder wahrend der Uebergangszeit 26,048 g in 100 Mohr'schen Cubikcentimetern.

fois le poids normal de sucre et compléter à 100 cc. ou plusieurs fois 100 cc. métriques.

On pourra employer comme déféquants et décolorants le sous acétate de plomb (3 parties en poids d'acétate neutre de plomb, 1 partie de litharge et 10 parties d'eau) ou l'alumine colloïdale de Scheibler ou l'alun en solution concentrée). Le noir animal et, en général, les poudres décolorantes doivent être exclus.

2. Dosage de l'eau: S'il s'agit de sucre normal, on fait le dosage de l'eau à la température de 105-110°.

S'il s'agit de sucre anormal ou de sucre colonial, on ne peut prescrire de méthode uniformément applicable pour les analyses commerciales.

3. Dosage des cendres. Opérer d'après la méthode Scheibler en employant de l'acide sulfurique pur concentré. L'incinération sera faite sur au moins 3 gr. de sucre dans une capsule en platine ou en porcelaine à la temperature la plus basse possible, c'est-à-dire aux environs de 750° C.

Du résultat obtenu par pesée, on retranche 1/10 et la teneur ainsi corrigée est inscrite dans le certificat d'analyse.

4. Alcalinité. Comme, d'après de recherches récentes, l'alcalinté du sucre brut ne donne pas une mesure de sa faculté de conservation, la Commission n'indique aucune prescription, concernant cette détermination.

5. Sucre inverti. Le dosage quantitatif du sucre inverti dans les sucres bruts sera effectué

tense flame (gas triple-burner with metallic cylinder, lense and reflector; gas lamp with Auer burner; electric lamp; petroleum-duplex lamp; sodium light).

The chemist must satisfy himself, before and after the observation, of the correctness of the apparatus (by means of correct quartz-plates) and in regard to the constancy of the light; he must also satisfy himself as to the correctness of the weights, of the polarization-flasks, the observation-tubes and the cover-glasses. (Scratched cover-glasses must not be used.)

Several readings are to be made and the mean thereof taken, but any one individual reading must not be relected.

Sugar Analysis.

1. Sucrose. To make a polarization, the whole normal weight for 100 cubic centimeters is to be used, or, a multiple thereof for any corresponding volume.

As clarifying and decolorizing reagents there may be used: subacetate of lead, prepared according to the *Pharm.-Germ.* (three parts by weight of acetate of lead, one part by weight of oxide of lead, ten parts by weight of water), Scheibler's alumina cream, concentrated solution of alum. Boneback and decolorizing parders are to be absolutely excluded.

After bringing the solution exactly to the mark and after wiping out the neck of the flask with filter paper, all of the well-shaken, clarified sugar solution

zu halten, sowohl beim Auflösen wie auch beim Polarisiren.

Für diejenigen Länder jedoch, deren Temperatur im Allgemeinen höher ist, ist zuzulassen, die Polarimeter bei 30° C. (oder einer anderen passenden Temperatur) zu justiren unter der Voraussetzung, dass die obigen Bedingungen genau eingehalten und die Beobachtungen bei der gleichen Temperatur vorgenommen werden."

Gegen das allgemeine Normalgewicht 20,00 wurden von Herrn François Sachs sowie von Herrn Regierungsrath Strohmer, Bedenken erhoben. Es wurde in Folge dessen beschlossen, von der Einführung desselben abzusehen, dagegen die Resolution angenommen:

„Es ist wünschenswerth, dass allgemein international ein einheitliches Normalgewicht eingeführt wird."

Es wurde ferner auf Grundlage des Vorschlages des Herrn Strohmer beschlossen, bei der Rohzucker-analyse folgende Regeln zu beobachten:

I. Polarisation.

„Bei Ausführung der Polarisation von Zucker enthaltenden Substanzen sind nur Halbschattenapparate zu verwenden.

Der Apparat muss während der Beobachtung eine fixe, unverrückbare Lage besitzen und soweit von der Lichtquelle entfernt sein, dass das polarisirende Nicol durch dieselbe nicht erwärmt wird.

d'apres la méthode Herzfeld qui est décrite dans la *Zeitschrift des Vereins für die Rübenzuckerindustrie des Deutschen Reichs.* 1886, page 6 et 7.

La Commission déclare en outre:

Que les échantillons de sucre doivent être conservés dans des flacons en verre bien bouchés;

Qu'ils doivent peser au moins 200 gr. si on veut que les résultats obtenus puissent prétendre à l'exactitude.

Toutes les décisions qui viennent d'être présentés ont été acceptées á l'unanimité par les membres présents.

Pour terminer, le Président fait remarquer que, la Commission ayant terminé ses travaux, n'a plus sa raison d'être et il la declare dissoute. Il demande seulement à l'assemblée de lui donner pleins pouvoirs pour la rédaction et l'approbation du procès verbal de la réunion.

M. Willey, au contraire, estime que la Commission doit se déclarer en permanence et il propose que M. Herzfeld soit maintenu à la présidence.

Cette proposition est accepté à l'unanimité.

M. Weichmann exprime ensuite au Président les remercîments de l'assemblée et la séance est levée.

Vendredi 27 juillet 1900.

Les membres de la Commission, conformément à la décision prise par eux, assistent à la séance du Congrès International de chimie appliquée (section V. sucrerie) et entendent la communication de M. Pellat, intitutée: „Influence de la température sur le pouvoir rotatoire spécifique de la saccharose"

Le Secrétaire,
Emile Saillard.

is poured upon a dry, rapidly filtering filter. The first portions of the filtrade are to be thrown away, and the balance, which must be perfectly clear, is to be used for polarization.

2. Water. In normal beet sugars the water determination is to be made at 105° to 110° C.

For abnormal beet sugars as well as for colonial sugars, there is no commercial method for the determination of water.

3. Ash. To determine the ash-contents in raw sugars the determination is to be made according to Scheibler's method, employing pure concentrated sulphuric acid. For an ash determination at least 3 g of the sample are to be used. The incineration is to be carried out in platinum dishes, by means of platinum or clay muffles, at the lowest possible temperature (not above 750° C)

From the weight of the sulphate ash thus obtained, 10% are to be deducted and the ash-content, thus corrected, is to be recorded in the certificate.

4. Alkalinity. As, according to the most recent investigations, the alkalinity of raw sugars is not always a criterion of their durability, the Commission abstains from proposing definite directions for the execution of the investigations.

5. Invert-Sugar. The quantitative determination of invert-sugar in raw sugars is to be made according to the method of Dr. A. Herzfeld. (*Zeitschrift des Vereins für die Rübenzucker-Industrie des Deutschen Reiches*, 1886. p. 6 u. 7.)"

Furtherm.ore the following resolutions were adopted:

Als Lichtquelle emfehlen sich Lampen mit intensiver Flamme (Gastriplexlampe mit Metallcylinder, Linse und Reflector, Gaslampe mit Auer'schem Brenner, elektrische Lampe, Petroleum-Duplexlampe, Natriumlicht).

Von der Richtigkeit des Apparates mittelst richtiger Quartzplatten und von der unveränderlichkeit des Lichts hat sich der Chemiker vor und nach der Beobachtung zu überzeugen, ebenso von der Richtigkeit der Gewichte, der Polarisationskolben, der Beobachtungsröhren und der Deckgläschen. (Zerkratzte Deckgläschen dürfen nicht verwendet werden.)

Man macht mehrere Ablesungen und nimmt daraus das Mittel, wählt aber nicht eine einzelne aus denselben aus.

II. Zuckeranalyse.

1. Bestimmung der Saccharose Für Ausführung der Polarisation ist das ganze Normalgewicht zu 100 ccm auszuwägen oder ein Vielfaches zu den entsprechenden Volumen.

Als Klär- und Entfärbungsmittel können verwendet werden: Bleiessig, bereitet nach der „Pharm. germ." (3 Gewichtstheile Bleizucker, 1 Gewictstheil Bleiglätte, 10 Gewichtstheile Wasser), Scheibler's colloidale Thonerde, concentrirte Alaunlösung. Knochenkohle und Entfärbungspulver sind unbedingt auszuschliessen.

Nach dem genauen Einstellen auf die Marke und dem Auswischen des Kölbchenhalses mit Filtrirpapier wird die gut durchschüttelte, geklärte Zuckerlösung auf ein trockenes, schnell

The Commission declares that only well closed glass vessels will ensure the stability of samples.

To obtain correct results it is desirable that the samples contain at least 200 g of material.

All of the above resolutions were adopted unanimously by those present.

The Chairman then declared that he considered the work of the Commission completed and he requested the Convention to authorize him to prepare and to accept the protocol and thereupon to declare the Commission dissolved.

Mr. Wiley however stated that he considered it necessary that the Commission be made a permanent one. He proposed that Mr. Herzfeld be again elected Chairman. His resolution was unanimously carried

After Mr. Wiechmann had expressed the thanks of those assembled to the Chairman, the session was closed.

Friday, July 27, 1900.

The members of the Commission, in accordance with the resolution adopted on Tuesday forenoon, attended the session of Section V of the International Congress for Applied Chemistry, and there heard the lecture of Mr. Pellat on the Influence of Temperature on the Specific Rotation of Sugar.

F. G. Wiechmann,
Secretary

filtrirendes Filter ihrer ganze Menge nach aufgegossen. Die ersten Antheile des Filtrates werden weggeschüttet, und wird dann das Nachfolgende, welches vollkommen klar sein muss, zur Polarisation verwendet.

2. Bestimmung des Wassers. Für normale Rübenzucke ist für die Wasserbestimmung die Temperatur 105–110° anzuwenden.

Für anormale Rübenzucker sowie für Colonialzucker giebt es keine Handelsmethode für die Wasserbestimmung.

3. Bestimmung der Asche. Behufs Ermittlung des Aschengehaltes in Rohzuckern ist die Veraschung nach der Scheibler'schen Methode unter Anwendung von reiner concentrirter Schwefelsäure vorzunehmen. Die Veraschung ist in Platinschalen mittelst Platin- oder Thonmuffeln bei möglichst niedriger Temperatur vorzunehmen (nicht über 750° C.).

Von dem ermittelten Gewichte der Sulfatasche sind 10% in Abzug zu bringen und der so corrigirte Aschengehalt in das Certificat zu stellen.

4. Alkalität. Da nach den neuesten Untersuchungen die Alkalität der Rohzucker nicht immer einen Massstab für die Haltbarkeit derselben giebt, so unterlässt es die Commission bestimmte Vorschriften für die Ausführung dieser Untersuchungen in Vorschlag zu bringen.

5. Invertzucker. Die quantitative Bestimmung des Invertzuckers in Rohzuckern ist nach der Methode Dr. A. Herzfeld's („Zeitschrift des Vereines für die Rübenzuckerindustrie des Deutschen Reiches", 1886, pag. 6 und 7) auszuführen.

Es wurden ferner folgende Resolutionen angenommen:

Die Commission erklärt, dass nur gut verschlossene Glasgefässe Gewähr für Unveränderlichkeit der proben bieten.

Behufs Erzielung richtiger Resultate is es wünschenwerth, dass die Proben mindestens 200 g Substanz enthalten.

Sämmtliche oben aufgeführten Resolutionen wurden einstimmig von den Versammelten angenommen.

Der Vorsitzenden erklärt darauf, dass er die Aufgabe der Commission für erledigt halte und er daher die Versammlung bitte, ihn noch zur Abfassung und Genehmigung des Protokolls zu ermächtigen und alsdann die Commission für aufgelöst zu erklären.

Demgegenüber betonte Herr Wiley, dass er für nothwendig erachte, dass die Commission sich in Permanenz erkläre. Er schlägt vor, abermals Herrn Herzfeld zum Vorsitzenden zu wählen. Dieser Antrag wird einstimmig zum Beschluss erhoben.

Nachdem Herr Wiechmann darauf noch dem Vorsitzenden den Dank der Versammlung ausgesprochen hat, wird die Sitzung geschlossen.

Freitag, den 27. Juli 1899.

Die Commissionsmitglieder wohnten gemäss dem am Dienstag Vormittag gefassten Beschlusse der Sitzung der Section V des internationalen Congresses für angewandte Chemie bei und hörten daselbst den Vortrag des Herrn Pellat über den Einfluss der Temperatur auf die specifische Drehung des Zucker.

662 Ex. I for Gov't.

Suit No. 2918.

Bartram Bros. *v.* U. S.
and two other suits.

The Question of Temperature-influence on the Specific Rotation of Sucrose.

By Ferdinand G. Weichmann, Ph. D.,

Member the International Commission for Uniform Methods of Sugar Analysis.

In studying the question of temperature influence on the polariscopic reading of a sucrose solution, it is important to pay due regard to the temperature at which the solution is prepared and to the temperature at which it is observed.

Two distinct cases call for consideration:

A. The sucrose solution is prepared at a given temperature but polarized at some other—higher or lower—temperature.

B. The sucrose solution is prepared at a given temperature and polarized at that same temperature.

In either case, if we assume the polarizations to be obtained by means of a quartz-wedge compensation saccharimeter the influence of temperature on the quartz-wedges of the instrument must be taken into account. If the readings on the saccharimeter be made at temperatures higher than the temperature at which the saccharimeter has been graduated, the readings obtained will be too low, if made at a temperature lower than the temperature at which the instrument has been graduated, the readings obtained will be too high.

Polarizations made on sucrose solutions prepared with the aid of clarifying reagents will—*eo ipso*—be too high on account of the unavoidable concentration of the solution, caused by the presence of the precipitate, a solid which is formed in the solution.

Disregarding for the present both of these possible factors of error let attention be confined for the moment to the manner in which the sucrose solutions themselves can be influenced by temperature changes in the two instances under consideration.

In the first case, *A*, a sucrose solution which exactly and wholly fills the polarization tube at the temperature at which the solution has been prepared and introduced into the tube, must, on suffering a change of temperature, necessarily change its volume.

If the solution be cooled it contracts; if heated, it expands.

663 In the latter instance a part of the solution will force its way out of the tube; in consequence, there will be less optically active solution in the tube at the higher temperature and the polarization then observed, must, of necessity, be lower.

In the second case, *B*, any change of volume of the solution is

avoided because the sucrose solution is polarized at the same temperature at which it has been prepared.

Concerning the result to be obtained under these circumstances there is a marked difference of opinion among investigators.

Some maintain that a solution of sucrose which gives a polarization of 100° Ventzke when prepared at 17.5° C. and polarized at 17.5° C., will also give a polarization of 100° Ventzke when prepared and polarized at respectively, 20° C., 25° C., 30° C., or at any other temperature, it being of course clearly understood, that proper correction is requisite for the influence of temperature on the quartz-wedges of the saccharimeter as well as for any precipitate-error, should such have been introduced through a clarification of the solution.

There are however some investigators who are opposed to the above contention. They claim that the higher the temperature at which sucrose solutions are respectively prepared and polarized the lower will be the polarizations obtained. In explanation of these alleged variations in the polarization-reading secured at different temperatures, they allege an influence of temperature on the specific rotatory power of sucrose.

The literature bearing on the question at issue may, for the sake of convenience, be divided, into two groups, one, in which an influence of temperature on the specific rotatory power of sucrose is claimed, the other, in which such influence is denied.

Among the writers whose names have been assigned, in some instances without proper warrant, to the former of these divisions, there should be cited:

1846. Dubrunfaut.
1889. Andrews, C. W.
1889. Petrucci and Sachs, F.
1889. Wartze, B.
1893. Gravier, E.
1895. Harrison, J. B.
1896. Sachs, F.
1897. Schönrock, O.
1898. Wiley, H. W.

Among the representatives of the second group, there may be named:

1842. Mistcherlich, E.
1843. Ventzke, K.
1858. Arndtsen, A.
1860. Berthelot, M.
1870. Tuchschmid, C.
1875. Hesse, O.
1878. Wachtel von, A. O.
1882. Lippmann von, E. O.
1890. Seyffart, J.
1893. Josse, A.
1897. Lippmann von, E. O.
1898. Seyffart, J.
1898. Wiechmann, F. G.
1899. Herzfeld, A.

664 To gain a thorough understanding of the question, to impartially regard the problem from the different points of view, the writer has deemed it necessary to study the pertinent publications of all of the authors named above. This he has done and herewith he respectfully presents for the consideration of the International Commission for Uniform Methods of Sugar Analysis his comments and criticisms on those writings.

Dubrunfaut, who is sometimes quoted as an early writer on this topic, is said to have maintained that temperature exerts an appreciable influence on the specific rotation of sucrose.

Reference to his article entitled: "Note sur quelques phénomènes rotatoires et sur quelques propriétès des sucres" (Annales de chimie et de physique [3], vol. 18. *1846,* pp. 99–107), shows him to state:

"Les dissolutions de sucre de canne, de sucre de fruit * * *, sont, parmi les substances que j'ai pu examiner jusqu'à présent celles qui subissent, dans leurs propriétés rotatoires, des changements qui varient avec la température" (pp. 100–101).

"Le sucre de canne n'éprouve qu'un abaissement de 0,04 dans son pouvoir rotatoire pris à 18,7 de température en le chauffant â 80 degrés. En corrigeant ce nombre à l'aide de coefficients de la dilatation du laiton (matière du tube) et du sirop, on trouve que le pouvoir rotatoire du sucre de canne, pour une transition de 100 degrés de température de o à 100 degrés, ne serait abaissé que de 0,0232 du pouvoir rotatoire pris à zéro; ce qui ne représente qu' une quantité très-petite par rapport à l'effet analogue que subit le sucre interverti" (pp. 101–102).

Dubrunfaut therefore evidently makes no statement beyond that of the fact he observed, that a solution of cane-sugar experiences a lowering of 0.04 of its rotatory power determined at 18.7° C., *when heated to 80 degrees.*

What other result than a lowering in polarization could possibly have followed such heating of a cane sugar solution?

But in what manner can this experience of Dubrunfaut's be construed into a claim that Dubrunfaut had ascertained a depression of the specific rotatory power of sucrose due to an elevation of temperature? His method of procedure undoubtedly caused decomposition of some of his sucrose, and of necessity resulted in the finding of lower polarization-values after the heating of the solution.

Dubrunfaut can therefore not be cited as an advocate of the views held by those who allege an influence of temperature on the specific rotatory power of sucrose.

Andrews, whose name is next on the list given, published two articles in the *Technology Quarterly,* May, 1899.

They shall be separately considered. The first of these is entitled: "The influence of temperature on the specific rotation of sugar cane" (pp. 367–371).

This investigation is based on the examination of two, and only two, sugar solutions.

665 The first of these was observed in a Laurent large model polariscope at 18° C. and at 41° C.

The second solution was read at 19° C., then 39.9° C. and finally at 20.1° C.

In speaking of the mean change in the specific rotation per degree centigrade, as found in the two determinations referred to, Andrews says:

"The agreement * * * is so close that there should be no serious error in taking the mean of the two," etc.

Let us examine how close this agreement really is:

Value found by first determination	0.0106
" " " second "	0.0122
Difference between the two determinations	0.0016

This difference amounts to 15.09 per cent. of the value first found and to 13.11 per cent. of the value found in the second determination—hardly a very close agreement considering the order of magnitude finally to be determined.

But, waiving this for the moment, let us examine the expression which Andrews obtains in "taking the mean of the two," to show the relation of the specific rotation to the temperature.

Andrews' formula is:

$$[a]\frac{t}{D} = [a]\frac{20}{D} - 0.000114(t-20).$$

This formula is wrong.

The corrected Andrews' formula, expressive of the influence of temperature on specific rotation, is the following:

$$[a]\frac{t}{D} - [a]\frac{20}{D} - 0.0114(t-20).$$

His results lead Andrews to find as "the coefficient of change per degree centigrade," the value 0.000171 on the basis of 66.50 as the mean value for $[a]\frac{20}{D}$.

In calculating his specific rotation value Andrews, in averaging some of his determinations says (p. 370): "It is evident that the variations of the separate readings from these means are due in part to two causes which are compensated for in taking the mean, viz., the difference in the temperature and *a slight eccentricity of the graduated circle and the optical parts of the instrument.*"*

666 It certainly seems justifiable to say—in the face of these statements and in consideration of the very limited experimental data on which Andrews' work is based—that his conclusions do not carry home conviction to those who are capable of drawing their own inferences as to the character of his investigation and the value of the data which he has secured.

The second paper of Andrews is given in the *Technology Quarterly* (May, 1889), pp. 372-378.

In this article Andrews states that unquestionably the most accurate results in polarizing can be obtained by making up all the solutions and reading them at the temperature at which the saccharimeter was graduated.

*Italics by F. G. W.

But as this "is inconvenient for rapid work," he has calculated "the factors by which the observed readings should be multiplied to obtain the true reading." Concerning the question of special interest to us he then states: "The change in the specific rotation of the solution was found from the formula:

$$1—0.000171\ (t-17.5).$$"

On p. 373, Andrews then gives four columns of factors adapted for use under various conditions. The only one of these of importance for our present purpose is the second column, which contains the factors for a solution made and read at t°, against quartz. These factors are calculated for the Ventzke standard solution in brass tubes.

The temperatures and the factors corresponding to the same are:

t	Factors.
10	0.9978
15	0.9993
17.5	1.0000
20	1.0007
25	1.0022
30	1.0036
35	1.0051
40	1.0067

Mean change per degree from 17.5 to 40 } 0.00030.

Andrews states that these factors may also be used without error for other solutions and glass tubes; the difference between glass and brass tubes being 0.0002 at 40° C.

Attention shall now be directed to the closing paragraph on page 373 and the data there given. This paragraph shall be quoted *in extenso*.

"That the corrections here given are not too large will be seen from a comparison of the reading of a standard solution on several different saccharimeters at different times. The solutions 667 were prepared by weight and the readings are the means of a large number of observations. The first column gives the actual reading at the temperature given; the second, these readings corrected by Matecgzek's table for density alone; the third, the same corrected by the factors given above.

	T.	1.	2.	3.
1 C. S. color	23	99.77	99.92	100.10
2 C. S. color	23.2	99.79	99.94	100.12
3 C. S. color	25.4	99.67	98.88	100.13
4 C. S. color	24.4	99.46	99.64	99.86
	27.9	99.39	99.68	100.00
5 S. & H. color	28	99.23	99.52	99.85
6 S. & H. shade	29	99.11	99.43	99.78
Mean			99.72	99.98
G-eatest variation from 100			0.57	0.22"

We have here readings obtained in six different saccharimeters and representing two different makers; five of these instruments were color instruments, and one was a half-shade saccharimeter. As Andrews makes no mention whatsoever as to having tested the correctness of these instruments, ann as he draws his mean from the readings obtained in them all, we must assume that they were all correct, or at least, that they were all equally correct.

Bearing this in mind and being informed by Andrews that the readings so recorded (in column 1), are the actual readings at the temperature given, obtained on "a standard solution," we must naturally wonder at the wide discrepancies exhibited by the figures recorded in column 1.

The temperatures comprised in these various observations vary from 23° C. to 29° C., that is to say, cover a range of only 7° centigrade. The differences in polarization, exhibited under these conditions referred to the highest polarization recorded as a standard of comparison, amount to:

T.	Differences.
23	—0.02
23.2	0.00
25.4	—0.12
24.4	—0.33
27.9	—0.44
28	—0.56
29	—0.68

In other words, for a difference of 60° centigrade a difference in polarization of 0.68° Ventzke is recorded.

Nor is the difference per degree centigrade within the range given at all uniform, as the following table shows:

668

Temperatures at which the readings were taken in the polariscopes.	Differences between the temperatures recorded.	Differences between the polariscope readings obtained in degrees Ventzke.	Differences in degrees Ventzke per degree centigrade.
23.2 and 25.4	2.2	0.12	0.054
23.2 " 24.4	1.2	0.33	0.275
23.2 " 27.9	4.7	0.40	0.085
23.2 " 28.0	4.8	0.56	0.116
23.2 " 29.0	5.8	0.68	0.117

Here we have values—degrees Ventzke per degree centigrade—which vary among themselves—to choose the extreme data secured—by more than 400 per cent.

And yet Andrews does not hesitate to combine them for the purpose of drawing "means" from them and for the purpose of employing them as the basis of an illustration of the need and the value of his "correction factors."

Regarding his column 3, it will be noticed that the difference between Andrews' *"corrected"* readings may amount to as much as 0.35° Ventzke. *Vide:*

100.13 and 99.78.

This difference corresponds to a difference of 3.6 degrees centigrade. For this range Andrews' maximum correction factor is 0.108 (*i. e.*, 0.03 × 3.6). Therefore, the variation in Andrews' "corrected" readings is equivalent to *three times* the maximum correction which he advocates.

Glancing at columns 2 and 3 of this table of Andrews, it will be seen that the first three out of seven of his figures in column 2, "corrected for density alone" come closer to 100, which should be the true value of his "standard solution"—than the corresponding values corrected also—by Andrews' factors—for the supposed influence of temperature. Compare column 3 with column 2.

	2. Diff.		3. Diff.
100.00	99.92 — 0.08	100.00	100.10 + 0.10
	99.94 — 0.06		100.12 + 0.12
	99.88 — 0.12		100.13 + 0.13
	99.64 — 0.36		99.86 — 0.14
	99.68 — 0.32		100.00 0.00
	99.52 — 0.48		99.85 — 0.15
	99.43 — 0.57		99.78 — 0.22

669 Only in one single instance is the value 100.00 obtained in his column 3 of "corrected" polarization values, while in three instances, were we to credit these figures, we would have to believe that "standard" sugar solutions can polarize *more than 100 per cent.!*

Passing on the work of Petrucci and Sachs, the writer regrets to state that their publication was not accessible to him. It is said to have appeared in the Bull. Assoc. Belge Chim., 15 Feb., 1889, p. 112.

However, in speaking of the experiments of Petrucci, Sachs says (Zeitschrift des Vereins für Rübenzucker Industrie, *1896*, p. 267) that he, Sachs, could not find the differences in polarization as great as Petrucci claimed to have observed.

As Petrucci's observations were made on sugar solutions, the temperature of which was allowed to drop from 17° C. or 18° C. down to 2° C. or 3° C. before polarization, his work is not in accord with the conditions which govern the polarization of solutions to be observed at the temperatures of their preparation.

Moreover as Sachs himself has discredited, or, at least, has been unable to affirm the correctness of Petrucci's claims, the latter may be dismissed from our consideration without further scrutiny.

In 1889 B. Wartze published an article "Ueber polarizations differenzen" (Die Deutsche Zucker-industrie, *1889*, p. 503).

From his statements it appears that he made up his solution at the temperature at which his sugar flasks were graduated (*i. e.*, presumably at 15.0° C. or at 17.5° C.), and that he then polarized the solution.

The temperature of the solution was next obtained by inserting a thermometer into the polariscope tube; the loss of solution caused by insertion of the thermometer was made good by the addition of some of the filtrate held in reserve and which had been guarded against evaporation.

The solution, thus anew enclosed in the polarization tube, was then either warmed or cooled.

The warmed solution was polarized and its temperature ascertained. In case of the cooled solutions the small air bubbles which had been caused by contraction of the fluid were displaced and replaced by the addition of a drop or two of the filtrate held in reserve and which was practically of the same temperature. The solution was then again polarized.

It is not surprising that under such methods of procedure, where on *warming* a part of the solution *escapes* by pressing through the rubber rings of the polariscope-tube, and where *after cooling, addition* of optically active solution is made to the original contents of the polariscope tube, that the readings at the *higher* temperature should always be *lower* than the readings obtained at inferior temperatures. The differences which occur are marked; wide discrepancies are shown. See the following table which exhibits variations of:

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0.9°	Ventzke	for a	difference	of	20°	C.
1.4°	"	"	"	"	24°	C.
0.3°	"	"	"	"	6°	C.
1.5°	"	"	"	"	28°	C.
0.6°	"	"	"	"	10°	C.
0.6°	"	"	"	"	11°	C.

Moreover, all of Wartze's tests here considered, were obtained in a saccharimeter which stood in a heated room. Therefore, aside from all other objectionable features, Wartze's results also suffer from a non-correction for temperature-influence on the quartz-wedges of his instrument, and certainly no inference can be drawn from his work as to whether or no temperature exercises any influence on the specific rotatory power of sucrose.

The investigation of Gravier, "Influence de la température sur la polarisation des liquides sucrés," appeared in the Bull. de l'Assoc. des Chimistes de Sucrerie et de Distillerie, vol. XI., 1893, p. 2–3.

His experiments were made with a Schmidt and Haensch saccharimeter and with the use of the normal weight 26.048 grammes.

Gravier studied particularly the effects of expansion and contraction on the results of the polarizations obtained, and also demon-

strated the error of Wartze's work in this respect, which has been referred to above.

Gravier's work was carried on with series of solutions made up respectively at 16° C. and at 32° C.

He found differences between the polarizations of these solutions, made up and polarized, as has been said, at 16° C. and at 32° C., and ascribes these differences to the influence of temperature on the rotatory power of the sugar-solutions, as in his experiments the influence of dilation and expansion of the solutions had been allowed for.

The error into which Gravier fell was that he did not allow for the influence of temperature on the quartz-wedges of his saccharimeter. He indeed had this source of error in mind, but unfortunately tried to learn whether the temperature affected his saccharimeter by observing the zero point of the instrument at 23° C. and again observing this zero-point after the temperature of the instrument had been kept for a certain time at 45° C. As he correctly observed, no change whatever could be noticed in the adjustment of the zero-point. But as is now well known (see Landolt, Optisches Drehungsvermögen Organischer Substanzen, p. 344), "only the zero-point is independent of the temperature, all other points of the scale, however, change their value with the temperature."

Gravier's results would have been different had he selected any other part of the saccharimeter-scale for his observations.

Passing reference may here be made to a paper by J. B. Harrison, dealing with the polarization of sugar in tropical climates (Timehri:
The Journal of the Royal Agricultural and Commercial Soci-
671 *ety of British Guiana.* Demerara, December 1895. Vol. IX. New series. Part II., pp. 378–382).

The article contains no evidence whatever in support of the statement, made by its *auditor*, that: "The rotatory power of sucrose solutions decreases slightly by rise of temperature (irrespective of changes of volume), and this has the same effect upon the polariscope indications."

The difference between the "true sugar polarizations" which he claims for the samples tested and the experimental data which he cites, may have been caused by one or more of several possible sources of error which, apparently, the author did not take into account at all.

In the first place, due allowance should be made for the influence of temperature on the saccharimeters used; the temperature of the instruments must have been about 28° C. throughout.

Having introduced the correction necessary to effect this (Jobin's correction), the remainder of the "residuary error" may have been caused by:

a. The presence of moisture—varying amounts in different experiments—in his sugar samples. In view of the very damp climate of the colony where Professor Harrison's work was done, this may very readily have been a disturbing factor.

b. The wedges or other quartz parts of some of his instruments may have suffered stress owing to the unequal rates of expansion of

quartz and the metal in which the quartz was set; this, of course, would vitiate the scale indications. In this connection it should be borne in mind that the instruments used were all built and graduated in a climate much cooler than the one in which they were used by the experimentator.

c. The scales of some of the instruments may have been faultily graduated in the first place.

The author has made no attempt to show that the causes here mentioned did *not* affect the results he obtained.

Until this has been done he is certainly without warrant in *arbitrarily* ascribing the differences, which he has *simply not accounted for,* to the influence of temparature on the specific rotatory power of sucrose.

It has been Professor Harrison's practice while in the West Indies "to standardize all the measuring instruments used to true cubic centimeters" (p. 379). His method of procedure, in getting around climatic difficulties in polarizing, is rather unique and deserves being quoted. He writes: "As the range of temperature here is not very great, I consider that the method used in the government laboratory for the last fourteen years is the best. Each 100-cubic-centimeter flask in use for sugar polarization is verified by weighing into it 99.533 grams of recently boiled distilled water at 28° C. The exact weight of chemically pure sugar, which when made up to a bulk of 100 cubic centimeters is one of the corrected flasks at 28° C., gives a polarization reading of 100°, is ascertained by experiment for each instrument and this weight of sugar is invariably used instead of the maker's normal weight for 17.5° C." (p. 382).

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The next study of our problem to claim attention is the work of F. Sachs on the "Influence of temperature on the polarization of sugar" (Zeitschrift des Vereins der Deutschen Zucker Industrie, 1896, pages 264–270).

The actual experimental work of this investigation is by Sachs credited to his assistant, P. Xhoneux.

Confining our attention solely to those of his experiments in which the sugar solutions were polarized at the same temperature at which they were prepared, we find the following:

	Series I.	Series II.	Mean.	Difference referred to value at 15° C.
Prepared at 15° C... } Observed at 15° C... }	95.30	95.30	95.30	0.0
Prepared at 20° C... } Observed at 20° C... }	95.25	95.20	95.22	—0.08
Prepared at 25° C... } Observed at 25° C... }	95.15	95.05	95.10	—0.20
Prepared at 30° C... } Observed at 30° C... }	95.00	94.90	94.95	—0.35

These observations were made on normal weight solutions.

Sachs adds:

"With more dilute solutions the influence of temperature would of course be even less."

Sachs has apparently neglected to introduce any correction for the influence of temperature elevation on the quartz-wedges of his saccharimeters.

It is true that, as far as we have been able to find, Sachs makes no specific mention of the temperature of his saccharimeter during his observations, but, presumably the saccharimeter of Sachs was also of the same respective temperature at which Sachs made up and polarized his solutions.

Assuming 15° C. to have been the temperature at which Sachs' polariscope was graduated, and using Jobin's formula, there must be *added* to the values found at 20° C., at 25° C., and at 30° C. respectively, the amounts:

0.076, 0.152, 0.228.

673 This brings the figures of Sachs to:

		Difference from value found at 15° C.	Difference in degree Ventzke per degree centigrade.
At 15° C. =	95.300 =	0.000	
" 20° C. =	95.296 =	0.004	0.0008
" 25° C. =	95.252 =	0.048	0.0048
" 30° C. =	95.178 =	0.122	0.0081

These differences all fall well within the allowable limit of experimental error, and it is, therefore, probable that the differences found by Sachs are wholly accounted for by the change in optical value which the quartz-wedges normally experience by the elevation of temperature, leaving no appreciable margin for any "lowering" in the specific rotatory power of sucrose induced by an elevation of temperature.

The work of Sachs would, therefore, rather seem to confirm the results obtained by the investigators whose views are in opposition to his own.

Referring to the experiments made by von Wachtel—as cited by Sachs in his paper just discussed—von Wachtel observed differences of 0.3, 0.2, 0.2, 0.3, 0.3, 0.3, or, in the mean, a difference of 0.27° Ventzke for a range of 8 degrees centigrade.

Of this amount, viz., 0.27° Ventzke, expansion of the fluid *is said to account* for only 0.11° Ventzke.

This, however, is wrong. As Landolt's work—Das Optische Drehungsvermögen Organischer Substanzen, 1898, states (p. 345), the change in polarization of a pure sugar solution *due to the change of volume, is 0.029° Ventzke for each degree of temperature.*

In the case of von Wachtel's figures we have, therefore, to allow for expansion—

$$0.029 \times 8 = 0.232^\circ \text{ Ventzke},$$

or, in other words, his experiments show a difference of only

$$\begin{array}{r} 0.270 \\ -\,0.232 \\ \hline = 0.038^\circ \text{ Ventzke} \end{array}$$

for 8 degrees centigrade. This is equivalent to a difference of only 0.0045° Ventzke per degree centigrade, a difference which may well be due to the cause suggested by von Wachtel himself, namely, expansion of the quartz-wedges of his polariscope.

Von Wachtel, therefore, is also in agreement with the investigators who deny that temperature exercises an influence on the specific rotatory power of sucrose. Sachs and Wiley have evidently been mistaken in seeking to adduce the work of von Wachtel in support of their contention.

674 Among the most important contributions to the question under discussion there must be reckoned the writings of Dr. O. Schönrock, Berlin. His publications have appeared in Professor Landolt's book: *Das Optische Drehungsvermögen Organischer Substanzen*, consult especially pp. 344–346, "The influence of temperature on the readings of saccharimeters," and in the Zeitschrift für Instrumentenkunde, 1897, vol. 17, pp. 178–181, where they appear in the report of the doings of the Physikalisch-Technische Reichsanstalt.

Dr. Schönrock's investigation was carried on with a polariscope and not with a saccharimeter, and it is very evident that he desired to take every precaution to secure accurate results.

In order to do full justice to Dr. Schönrock's work it has seemed best to the writer to quote at length Dr. Schönrock's remarks bearing on this matter, as given in the journal cited above.

"(*b.*) Angaben über die erreichte Genauigkeit bei der Bestimmung der specifischen Drehung des Rohrzuckers.

"Wie im letzten Bericht auseinandergesetzt worden ist, sollte zunächst behufs Ermittelung das alten Hundert punkts der Ventzke'schen Skale bei 17.5° für Natriumlicht die specifische Drehung [a] einer Rohrzucker-lösung bestimmt werden, die bei 17.5° in 100 wahren ccm. (1 ccm. = Volumen von 1 g. Wasser bei 4°) 26,003 g. Rohrzucker (wirkliche Masse) enthält.

"Zunächst machte eine scheinbare geringe Zunahme der Drehung einer und derselben Zuckerlösung mit der Zeit einige Schwierigkeit, welche sich erst dann löste, als man dem Verschluss der Röhre eine über die gewöhnlichen Vorsichtsmassregeln weit hinübergreifende Aufmerksamkeit zuwandte. Die Schwierigkeit, ein Verdunsten des Wassers aus der in der Polarisationsröhre enthaltenen Zuckerlösung, zumal bei Temperaturänderungen zwischen 12° und 25°, vollkommen zu verhindern, ist viel grösser, als man gewöhnlich annimmt. Da die Röhre etwa 73 g. Lösung enthält, so ändert das

Verdunsten von 1 mg. Wasser die Drehung a um beiläufig 1/60,000 ihres Werthes. Das Verdunsten liess sich erst dann bis auf 1 cg. und weniger reduziren, als man folgendermaassen verfuhr. Die Deckgläschen werden nicht wie gewöhnlich durch übergeschraubte Deckel gegen die Röhre gepresst, sondern mit gerade im Erstarren befindlichen Klebwachs angekittet, doch so, dass sie direket mit den Endflächen der Glasröhre in Berührung bleiben; die in Rechnung zu setzende Verschiebung des Nullpunktes durch die leere Röhre betrug dann nie mehr als ⌀ 30″. Die Füllung der Röhre geschieht durch eine seitliche Oeffnung, die mit einem geschliffenen Glasstöpsel verschlossen werden kann, durch welchen ein Thermometer in das Innere der Lösung hineinragt. Die nunmehr noch eintretende Verdunstung liess sich auf ⌀ 1 mg. ermitteln." * * *

"(*g.*) Abhängigkeit der specifischen Drehung von der Temperatur.

" Es is unbedingt erfordelich, regelmässige Wägungen der
675 gefüllten Polarisationsröhre auszuführen, um Gewissheit über die erlangeten Resultate zu haben; da nun wegen dieser Wägungen eine Wasserpülung zum Konstanthalten der Temperatur nicht angewendet werden kann, so entstand die Forderung, sich über eine etwaige Abhängigkeit der specifischen Drehung $[a]$ von der Temperatur t Gewissheit zu verschaffen. Bisher wurde stets angenommen, dass $[a]$ gar nicht oder in ausserordentlich geringem Maase mit t variirt, eine Annahme, die sich auf die Beobachtungen von Tuchschmid, Seyffart und Andrews (? F. G. W.) stützte. Das Vertrauen zu diesen Beobachtungen wurde aber bereits bei den im vorigen Bericht erwähnten Vorarbeiten mit einem Saccharimeter ershüttert, weil in die bei Zimmertemperatur zwischen 18° und 20° erhaltenen Resultate nur dann Uebereinstimmung zu bringen war, wenn man etwa $\frac{d\,[a]}{d\,t} = -0{,}02$ setze. Dass dieser Werth von der richtigen Grössenordnung war, beweisen die bisher zwischen 12° und 25° untersuchten zehn Zuckerlössungen, welche für $\frac{d\,[a]}{d\,t}$ Werthe ergaben, die ausnahmlos zwischen den Grenzen $-0{,}0151$ und $-0{,}0132$ liegen, im Mittel $\frac{d\,[a]}{d\,t} = -0{,}0144$.

" Nimmt also die Temperatur der Zuckerlösung zu, so nimmt der Drehungswinkel ab, erstens weil die Konzentration der Lösung wegen der Volumvergrösserung abnimmt, und ausserdem noch, weil die specifishe Drehung kleiner wird. Da der zweite Betrag 3/4 des ersteren beträgt, so darf man da, wo man die Konzentrationsänderungen in Rechnung zieht, auch die Anderungen in der specifischen Drehung keineswegs vernachlässigen."

From this it appears, that in order to guard against evaporation of water from the sucrose solutions on warming the same, Dr. Schönrock fastened glass covers permanently on his polariscope-tube. The sucrose solutions were introduced through an opening provided in the side of the tube, which opening was closed with a ground-glass stopper.

It seems to the writer that the results of Dr. Schönrock cannot be accepted as above criticism on account of these very precautions which were taken by him.

Dr. Schönrock himself states that the glass covers of his tube were optically active even when the tube was empty (p. 180).

The effect of stress on the optical behavior of glass is well known. The warming up of the sugar-solutions in the tube must have caused pressure upon the cover-glasses in consequence of the expansion of the fluid confined between them.

In this connection it will be proper to recall attention to the article by Dr. C. Scheibler, Ueber den Einfluss der Deckgläschen für Beobachtungsröhren bei der optischen Zuckerbestimmung (Zeitschrift des Vereins f. d. R. Z. I. d. D. R. R., *1869*; vol. 19, pp. 50–52), and especially to the work of Dr. Paul Degener, Ueber das optische
676 Verhalten der Polarisations Deckgläschen (Zeitschrift des Vereines fur die Rübenzucker-Industrie des Deutschen Reichs, vol. 32, *1882*, pp. 861–865).

Degener found that the glass covers of a polarization-tube, which glasses polarized the light but slightly while the tube was empty, exercised a very pronounced effect as soon as the tube was filled with water or with alcohol. This result was due to the additional pressure which the confined column of fluid exercised upon the glass covers.

The deflections in the plane of polarization which Degener thus produced solely by the pressure of optically inactive solutions on the glass-covers of his polarization-tube ranged from a few tenths of a degree to three degrees Ventzke. In some instances the rotations produced were to the right, in others, in fact in most cases, to the left.

Similar variations in rotation were encountered by Dr. Schönrock. As a rule he noticed a decrease in the dextro-rotation of his solutions on raising their temperature. This—in view of Degener's experiments—may well have been caused by the glass-covers of his polarization-tube becoming levo-rotatory in consequence of the pressure exerted upon them through the expansion of the confined solution.

However, Dr. Schönrock also found that: "the specific rotation in time *increased* by amounts up to 0.044 and this without evaporation having taken place" (*loc. cit.*). It is evident that an increased dextro-rotation of the cover glasses, caused by pressure, could also have produced this very effect.

Professor Herzfeld, the great German authority on sugar, in an article published in the *Zeitschrift des Vereins der Deutschen Zucker Industrie*, Jan., 1899, referring to Schönrock's formula bearing on the decrease of specific rotation of sugar solutions through an increase in temperature, states that his own (Herzfeld's) experiments, as well as the few observations which have hitherto been published on raw-sugar solutions, are not in particular accord with the views embodied in Schönrock's statement.

In the April number, 1900, of the *Zeitschrift des Vereins der Deutschen Zucker-Industrie* (pp. 413–434) Dr. Schönrock has published a detailed résumé of his prior work, which has here been dis-

cussed. He has also added the data of some additional experimental work recently undertaken by him.

Dr. Schönrock finds no occasion to change the conclusion he had previously reached; on the other hand, the present writer can find nothing in this new statement of Dr. Schönrock's work which would alter the impression he has gained from a study of the earlier writings of this investigator.

The data which Dr. Schönrock found on testing his polariscope tubes with pure water, at different temperatures, serve but to emphasize the danger which threatens from the pressure exerted by expanding solutions.

677 These tests show such wide discrepancies and variations that it would seem impossible to deduce from them any average allowance factor which could be taken into account in estimating the influence of this source of error on his results. Especially does this appear evident in view of the statement made by Dr. Schönrock himself (p. 421) where he says, that the pressure of the expanding sugar solutions, when experiencing changes of temperature between 10° and 32° C., was so great, that an escape of the solutions at the cover-glasses could not be prevented when these were held in place by the customary screw-caps and rings of caoutchouc or soft leather, although an empty tube attached to the middle of the polarization-tube, had been provided to accommodate the expanding solution.

Attention must also be called to the fact that the specific rotatory power of the different sucrose samples which Dr. Schönrock has employed, vary by as much as 0.8 *vide* 65.8 and 66.6.

No explanation is offered as to the cause of these great variations in the specific rotatory power of the sucrose samples with which Dr. Schönrock has worked and upon the examination of which he has based his conclusion.

One is therefore confronted by the possibility of the presence of some unknown, but optically active substance, or substances, endowed with a rotatory power readily affected by temperature-changes, which also might well serve to cause, or at least to contribute to the variations observed by Dr. Schönrock.

The latest contribution to the cause of those who hold that temperature exercises an appreciable effect on the specific rotatory power of sucrose is to be found in an article by Professor Harvey W. Wiley of Washington, D. C.

Professor Wiley read this paper before the Third International Congress of Applied Chemistry at Vienna, Austria, 1898, and also before other scientific bodies. His article has appeared in several journals, among others in the *Journal of the American Chemical Society*, July, 1899, there bearing the title: *The influence of temperature on the specific rotation of sucrose and method of corrected readings of compensating polariscopes therefor.*

Briefly stated, Professor Wiley's contention is this: Sugar solutions made up and read at temperatures other than the temperature at which the saccharimeter employed in their observation has been graduated, will show readings varying with those temperatures.

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The higher said temperatures are above the temperature at which the saccharimeter has been graduated, the lower—so claims Professor Wiley—will be the readings which are obtained.

This lowering of the polarization reading is, according to Professor Wiley, essentially due to two causes:

(*a.*) The influence of temperature elevation on the optical value of the quartz wedges of the saccharimeter employed.

(*b.*) The decrease in specific rotation which—so Professor
678 Wiley assumes—solutions of sucros- experience through an elevation of temperature.

In the commencement of this article Professor Wiley refers to several investigators whose work, he claims, support- his own contention.

As these writings have already been discussed in this paper, it will not be necessary to refer to them again, save, perhaps, to remark that in the light of experience and knowledge gained since most of these researches, cited by Professor Wiley, have been made, it has proved no difficult task to point out their defects and shortcomings. In many instances, though not in all, the use of defective saccharimeters has undoubtedly been to blame for some of the peculiar results obtained.

A fundamental defect of Professor Wiley's investigation, so it appears to the writer, is the fact that he has employed as his point of departure in his investigation *a mixture of sucrose and mercuric chloride solutions.*

It is shown in the text on p. 574, that the whole investigation is based on one stock solution of sucrose, "a thick sirup having almost exactly fifty per cent. of pure sugar and fifty per cent. of water. This sirup was preserved by having added to the water before solution an appropriate quantity of mercuric chloride."

In making a scientific study of the properties of a substance, it is the usual practice and absolutely essential to prepare that substance as pure as possible and if the substance be perishable, *i. e.*, easily changed in composition—to work with it in its most stable form.

Professor Wiley in working with a *solution* of sucrose and in adding to that solution of sucrose a *foreign substance*—mercuric chloride—has certainly placed himself in opposition to all well founded custom and practice in both of the respects indicated.

When we are furthermore informed that the experiments with the above solution extended over a period of at least four days (April 12th to 15th, inclusive), during which time said solution was exposed to temperatures varying from 4° C. to 40° C., it seems incredible that Professor Wiley should have succeeded in "having an absolutely unvarying quality of sugar solution" (p. 574) such as he desired to employ in his investigation.

The writer's conviction on this point is based—not on surmise, but on experience. To test the matter he prepared a 50 per cent. solution of pure white sugar-liquor and of this placed 400 cubic centimeters into a 500 cubic centimeter flask. After the specific gravity of this solution has been very carefully determined by a pyknom-

eter, the flask was well corked and set aside for 24 hours in a place the temperature of which throughout that time was practically constant at from 23° to 24° C. The specific gravity of this solution at the beginning of the experiment was 1.23390. Twenty four hours later it was 1.23565. The first of these specific gravity values corresponds to 50.20° Brix, that is to say to 50.2 per cent. of
679 sucrose, while the second specific gravity value represents 50.5 per cent. In other words, this sucrose solution had changed its sugar content by 3/10 of one per cent. through evaporation of water into the air space above the solution.

Professor Wiley worked entirely with one stock solution, of which double the normal weight—*i. e.*, 52.096 grammes—were weighed off for each determination. It appears that all of the experimental data obtained by Professor Wiley were secured on thirty-eight solutions. Observations were made at eight different temperatures; in six of these determinations five solutions were used, in the remaining two instances four solutions were employed.

As readings on all sets were made in triplicate, the total number of readings made on the thirty-eight solutions amount to four hundred and thirty-six.

Four hundred and thirty-six readings made on thirty eight solutions would represent on the average, eleven or twelve readings per solution, a number which should be ample to determine accurately the reading value of the solutions examined.

Professor Wiley says. "In each case unless otherwise noted, five solutions were used and each solution was read four times, or more *if there were errant readings*, and *the mean of the four concordant readings* taken as representing the true reading."

Referring to the words underscored in the above sentence, by the present writer, it is, of course, necessary, or least desirable, to exclude from a given series any and all observations which can be truly considered as unsatisfactory. However, as Lupton says, in his *Notes on Observations* (p. 84): "The rejection of doubtful results is a most delicate and difficult subject. Great care should be exercised, that it never takes place consciously or unconsciously in favor of a preconceived theory by which the judgment is very liable to be biased."

If "the four concordant readings" were selected to secure "the true reading," *simply because they were concordant*, serious exceptions might well be taken to this procedure.

In order that a "mean" shall be correct it is necessary that the data from which it is obtained shall be strictly comparable *inter se*.

Professor Wiley, however, in "order to secure a better check on the readings," secured his sets of readings as follows: he obtained one set with the white-light telescope, one set with the yellow-light telescope and one by inserting in the instrument a left-handed quartz plate of known value.

Now it is a well known fact that the nature and the color of the light employed in making observations on a polariscope, materially affect the results obtained. But Professor Wiley takes as his mean polarization (p. 580), the average values of *all* the results obtained.

The objection here raised seems especially pertinent when it is borne in mind that the "yellow light" values were partially secured in three different ways, viz: by means of a chrystal of potassium bichromate, by a yellow glass plate and by a solution of potassium bichromate. Even the source of light varied, for although generally gas was used, yet kerosene light was employed in some of these determinations.

Professor Wiley himself seems to be aware of this cause of disturbance here referred to, for he says (p. 575):

"The variations in the readings of the standard quartz plates which will be noticed in the data here and following, *aside from the nature of the light*,* are due to differences in setting the double quartz wedge compensation and not to changes in the rotatory power."

Attention is next invited to the "table of corrections for polarizations made with quartz-wedge compensating polariscopes at temperatures other than the standard temperature of 17.5° C.," which is given on pp. 581, 582 of Professor Wiley's article.

These "correction-factors" cover the temperatures from 4° C. to 40° C. "for sugars of different content of sucrose" (p. 580).

This range of sucrose content extends presumably from 100 per cent. to 75 per cent. for the table exhibits values from 100° to 75° Ventzke.

These values are all based on observations made at eight different temperatures on solutions of "pure sugar" (p. 580).

Has Professor Wiley any evidence to show that sugars containing as high as 25 per cent. of matter *not sucrose*, behave exactly analogous to a sugar testing practically 100 per cent.? If he has such evidence it certainly does not appear in the article under consideration. Without proof to that effect, the broad generalization here made—the basing of 962 "correction factors" on observations made on *one* stock solution of pure sugar at eight different temperatures—can hardly be expected to inspire confidence in regard to its intrinsic merit.

Professor Dr. A. Herzfeld in the *Zeitschrift des Vereins der Deutschen Zucker Industrie*, January, 1899, p. 19, says: "I am occupied with a continuation of the work, inasmuch as I am first of all determining whether raw sugar polarizations give, at different temperatures, readings which correspond to the theoretical values calculated for sucrose by means of known formulæ." And caution in this respect seems particularly to be commended when one recalls the classic research of R. Nasini and E. Villavecchia, Sul peso normale pei saccarimetri, Roma 1891. (On the normal weight of polariscopes.) In this investigation of 78 samples of *pure* sucrose, prepared from all sorts and kinds of raw sugars, refined sugars, molasses, etc.—the specific rotatory value of sucrose at 20° C. was found to vary within rather wide limits.

The Imperial Technical Institute at Berlin is, according to late accounts, even now engaged in preparing for a series of determina-

* Italics by F. G. W.

tions of the specific rotatory power of chemically pure sucrose.

Therefore, to announce the extent to which the specific rota-
681 tory power of sucrose is affected by changes in temperature—per degree centigrade—when the *constant* which is *assumed* and *presumed* to suffer such change, has not even been definitely and indisputably determined, is an undertaking which can certainly not hope to escape challenge and criticism.

According to Professor Wiley, the use of correction factors is called for regardless of the fact that the slight, unavoidable lowering in the reading of a sugar solution, caused by the influence of an elevation in temperature on the quartz wedges of the saccharimeter, is offset, and more than offset in practical sugar polarizations, by the unavoidable concentration of the sugar solutions which is caused by the precipitate formed in clarifying. The numerical value of Professor Wiley's "correction factors" is proportionate to the temperature at which the polarizations are made. To test this system of correction-factors strictly on its merits, a number of tests were made with practically pure sucrose (Polarization = 99.98). Thus any and all undue concentration of the solution examined was avoided as no clarifying re-agent was needed in preparing them for observation in the saccharimeter. This work was carried on by several observers, the writer among the number. The solutions were all most carefully prepared in verified Mohr flasks and were polarized at the same respective temperatures at which they were prepared. Some of the observers used a sensitive color-saccharimeter, while the others employed a Schmidt & Haensch half shadow instrument. The data are given in the following table:

Test No.	Reading observed.	Temperature, degrees centigrade at which solution was prepared and the readings taken.	Wiley's "Correction-factor" derived from his table. To be added to the reading found.	"Corrected" polarization according to Professor Wiley's data.
1	99.90	23.0°	0.18	100.08
2	99.85	24.5°	0.22	100.07
3	99.90	25.0°	0.24	100.14
4	99.90	25.7°	0.26	100.16
5	99.90	26.5°	0.28	100.18
6	99.90	27.5°	0.32	100.22
7	99.90	29.0°	0.37	100.27
8	99.85	30.0°	0.40	100.25
9	99.80	31.7°	0.45	100.25
10	99.80	33.0°	0.50	100.30

From this record it clearly appears that the use of Professor Wiley's so-called "correction-factors" would ascribe to pure sucrose—at the temperatures at which the experiments were made—a polarization of over 100 per cent. The excess over and above 100 per cent. will be seen to keep pace with the rise of the thermometer; further comment is certainly unnecessary.

682 In giving his table of the "Specific rotatory power of sucrose at temperatures ranging from 20° to 40° C." on page 594 of his article, Professor Wiley states: "The observations were made with a triple-field saccharimeter, the readings being converted to angular degrees by use of the factor 0.3462."

These "equitable angular degrees with sodium light" appear in Professor Wiley's table and are made the basis of the various values of [a] which he determined for different temperatures.

In choosing his instrument, his source of illumination, etc., Professor Wiley has put aside wholly the cautioning and advice of Professor Landolt and of Dr. Schönrock. Thus Landolt writes: (*Zeitschrift des Vereines für Rübenzucker Industrie*, 1888, vol. 38, p. 32): "One will therefore do better not to employ instruments with quartz-wedge compensation and illumined by a white light for the determination of specific rotatory values [a] D, but to always use for this purpose regular polaris-trobometers."

Dr. Schönrock says, in speaking of making observations with white light and half shade saccharimeters (see Landolt *Das Optische Drehungsvermögen Organischer Substanzen* II. ed. 1898, p. 378): "If the rotation obtained in Ventzke degrees be multiplied with the factor 0.347 [Professor Wiley uses the factor 0.3462] one can at least say, that the product so obtained, the angle of rotation in circular degrees for sodium light, is accurate to within *about two or three per cent.*"*

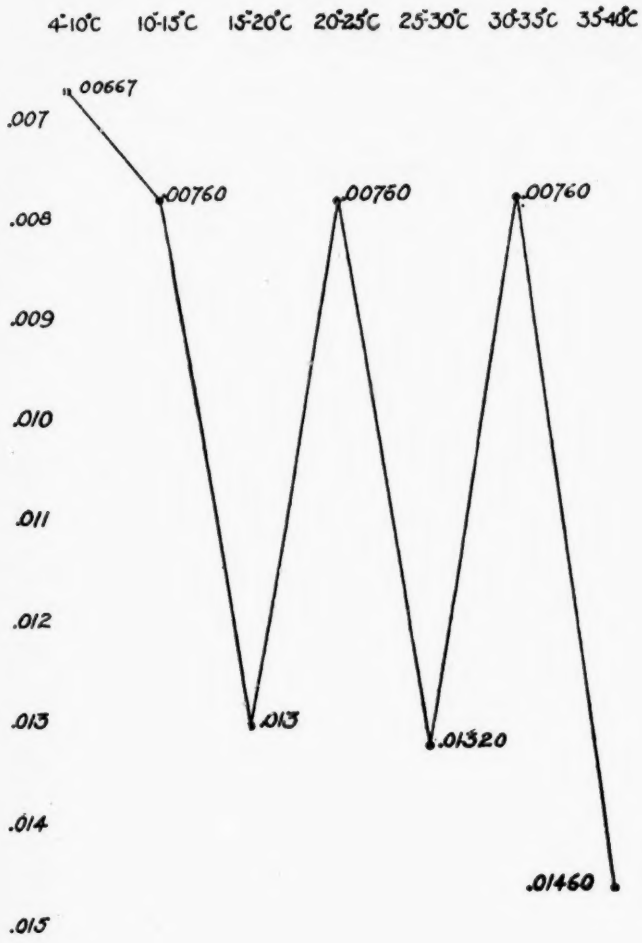
Dr. Schönrock then continues: "There is no sense in seeking to determine for individual substances more accurate factors of calculation (Umrechnungs factoren (*as accurate measurements without material systematic errors can never be made with a saccharimeter,** on account of rotation dispersion, influence of temperature and the changeability of the rotation due to the illumination and the color-sense of the observer. Therefore, if it is possible, avoid the use of a saccharimeter and obtain for illumination of a polarizing apparatus, intense sodium light, the preparation of which, moreover, causes but slight trouble."

Thus there will hardly be need for "the numerous series of observations" which Professor Wiley deems requisite, to determine the cause of the material differences in the data tabulated on p. 594.

It does seem surprising, however, that Professor Wiley should be willing to base on the data he has tabulated the final conclusion of his investigation, the claim that "for each change of one degree in the temperature the polarization of a pure sugar on an instrument with a Ventzke scale suffers a change of 0.01494° (this is = 0.005172 circular degrees) due excessively to the change in the specific rotatory power of the sugar solution" (p. 593).

Consulting his table (p. 594) it is seen that the difference per 1° C. in the specific rotatory power of sucrose differ amongst themselves by as much as 0.0229° Ventzke (= 0.00793 circular
683 degrees) [*vide:* 0.01460 and 0.00667]. Professor Wiley's factor is therefore, so it appears, based upon a series of deter-

* Italics by F. G. W.


4-10°C
10-15°C
15-20°C
20-25°C
25-30°C
30-35°C
35-40°C
.00667
.00760
.00760
.00760
.013
.01320
.01460
.007
.008
.009
.010
.011
.012
.013
.014
.015

minations—made upon *one* original stock solution of sucrose—which determinations exhibit amongst themselves differences per degree centigrade to the extent of very nearly one hundred and nineteen per cent.

This marked discrepancy hasbeen noted and commented upon also by others. Thus in the notice of Professor Wiley's article which appeared in *The Analyst*, vol. 24, No. 284, November, 1899, p. 288, the reviewer writes, in referring to the variations in the specific rotatory power of sucrose due to temperature-influence, as found by Wiley: "It appears, however, that the variations are not uniform, the rate of decrease being greater (nearly double), between 15° and 17.5°; 20°-25° and 30-35° C., than elsewhere in the series.

(Insert diagram marked p. 684.)

The diagram on the foregoing page depicts graphically the difference of the specific rotatory power of sucrose per degree centigrade, at different temperatures, as determined by Professor Wiley's experiments.

The peculiar character of the plotted line, showing such marked alterations of elevations and depressions, is certainly not calculated to dispel the grave doubts expressed as to the value of the experimental data on which it is based.

A critical survey of all of the literature thus far examined has therefore failed to disclose a single, indisputable demonstration of the correctness of the contention that temperature exercises an influence on the specific rotatory power of sucrose.

On the other hand, evidence to the contrary exists in abundance. It appears, in fact, that a *majority* of the scientists who have carefully studied the question have reached the conclusion that the specific rotatory power of sucrose is a constant. In their work some have employed polariscopes, others have used saccharimeters.

It would be impracticable to discuss here in detail all of these investigations. The following quotations, arranged in the chronological order of their publication, will prove sufficient to express the views of their authors on the matter at issue.

1842. Mitscherlich, E., Gesammelte Schriften, Berlin, 1896.

"With some substances the temperature has no influence; for instance, with cane sugar" (p. 554).

1843. Ventzke, K., Journal für Praktische Chemie, vol. 28.

"Influence of temperature on circular polarization.—In cane sugar solutions of 25 per cent. strength I had frequently made the observation that a marked elevation of temperature had no influence upon its deflection to the right" (p. 101).

685 "Hence I feel that I am justified in assuming for the practical ends here pursued, as only sugars are concerned which have a dextro-rotation, that in any case, *the temperature during observation* has no influence, and hence can be let out of consideration" (p. 103).

1858. Arndsten, A., Annales Chim. Phys., vol. 54.

Arndsten in studying the molecular rotatory power* of sugar solutions with various wave-lengths of light, says:

"One sees that the values found, agree for all wave lengths in such a manner that it is indisputable that the molecular rotatory power of sugar, is strictly a constant" (p. 408).

1860. Berthelot, M., Chimie Organique fondée sur la Synthèse, Paris.

Under the caption *Saccharose* the author says:

"Its rotatory power is right handed. * * * It does not vary appreciably with the temperature" (vol. 2, p. 255).

1870. Tuchschmid, C., Journal für Praktische Chemie, vol. 110 bd. 2.

This investigation was made in the laboratory of Professor H. Landolt. Tuchschmid writes:

"Therefore, the statement may be made with positiveness: The molecular rotatory power of pure sugar solutions is independent of the temperature" (p. 245).

The range of Tuchschmid's experiments was from 10.4° C. to 40.5° C., a range of 30.1° C.

1875. Hesse, O., Liebig's Annalen der Chemie (vol. 176).

In that part of his investigation bearing on sucrose the investigator says:

"The solution of the sugar took place in the cold, although warming of the solution did not exert a deleterious effect upon its rotatory power" (p. 97). Hesse's experiments were carried on at temperatures between 15° C. and 25° C.

1878. Von Wachtel, A. O. Oester: Ung: Zeitschrift für Zucker-Industrie, etc. (vol. 7).

Von Wachtel finds that the temperature exercises no influence on the specific rotation of sucrose. Reference to his work and demonstration of this fact have previously been given. See also Von Lippmann "Die Chemie der Zuckerarten," 1895, page 672.

686 *1882.* Von Lippmann, E. O., Die Zuckerarten und ihre Derivate.

"Temperature is without influence on the rotation of sucrose" (p. 117).

*Molecular rotary power is the value obtained by multiplying the specific rotatory power of an optically active substance by its molecular weight divided by one hundred. (Landolt, Opt: Dreh: Org: Subst: pp. 5 and 6.)

1890. Seyffart, J., Annalen der Physik und Chemie Neue Folge, Band 41.

Seyffart's classic research, made in the laboratory of Professor Wiedemann, at Leipzig, determined that for a 20 per cent. sucrose solution the rotations for the seven lines of the spectrum were identical at the temperatures of 15° C. and 65° C. It proved that the specific rotatory power of sucrose is a constant for that range of 50° centigrade. Seyffart says:

"The observation of Tuchschmid, with regard to *the constancy of the specific rotatory power of sucrose solutions at different temperatures*, is confirmed by the present investigation and is supplemented in regard to its validity *for all colors of the spectrum.* Hence *dispersion also is independent of temperature*" (p. 129).

1893. Josse, A., Bull. de l'Ass. des Chimistes, etc., vol. 11.

"Desirous on my part to make a few experiments on this matter, I undertook a series of observations without seeking to attain to mathematical exactness like the preceding authors, but confining myself simply to the precautions of ordinary practice. My conclusion is that a difference in temperature of 25° C. has no more than a negligible influence upon a sugar solution of the normal weight of 16 gr. 20" (p. 261).

1897. Von Lippmann, E. O., Zeitschrift des Vereins für Rübenzucker-Industrie, vol. 47, Tech. Theil.

"It is known to you that temperature does not effect a change in the rotatory power of cane-sugar as such" (p. 651).

In conclusion there shall be quoted at length some remarks made by Dr. Seyffart in a convention of the Sachsisch-Thüringischer Zweigverein der Deutschen Zucker-Industrie at Halle a. S., Germany, which took place December 15, 1898.

This statement is one of particular interest and importance because it so clearly points out and emphasizes the error in polarization resulting from the employment of various sources of light, a matter upon which comment has already been made in an earlier part of this paper while discussing the investigation of Professor Wiley.

1898. Seyffart, J., Die Deutsche Zucker-Industrie, No. 52, Beilage 1.

"There are principally two causes which bring about the differences in analyses (of sugar) that have been reported. On the one hand it is the influence of the temperature on the polarizing
687 apparatus caused by the heat rays which emanate from the source of light and which cause stress effects in the mechanical and optical parts of the polariscopes in connection with the various screw-fastenings and cementings of the same; these must bring about a deflection of the light rays.

"In order to avoid this source of error I have always moved the polarizing apparatus as far away as possible from the polarizing lamp—at least 5 to 7 inches; furthermore, after every observation the apparatus is to be turned a little away from the light, for which, reason the instruments which can be turned are more practical than those which are fixed in their position.

"The second and very important cause of the differences in polarizations lies in the various sources of light which are employed in the various laboratories. In part petroleum light is used, in part gas light, in part incandescent gas light, in part electric incandescent light.

"Not one of these white lights possesses, when measured in the spectroscope, the same brightness of spectrum in its various parts, and the mean effect of these various kinds of light is by no means identical with respect to the rotation of the plane of polarization.

"How can one expect absolutely identical degrees of rotation with such various sources of light when we well know that, for instance, petroleum light contains many more red and fewer violet rays, while the spectroscopic composition of the incandescent gas light is rather the reverse, and although we know that the angle of rotation for violet rays is much larger than for red rays?

"The resultant of the varicolored rays which are united in white light can hence never be absolutely identical for the various sources of light, and to secure a better agreement in the results of polarization, it is, hence, necessary to come to an agreement as to some source of light which shall be used once and always, and in all places."

Speaking of some recent observations concerning the increase of the angle of rotation for sugar solutions by temperature, Seyffart calls attention to his investigations which he had previously made in the physical laboratory of Professor Wiedemann in Leipzig, and according to which the angle of rotation remains absolutely constant even up to a temperature of 60° centigrade (see reference previously given.) Seyffart says:

"I will admit that it may be possible that one can perhaps nowadays work even more accurately with the polarizing instruments which have in the meantime been perfected, but which are also very complicated.

"However, an increase of the angle of rotation up to 0.6° I consider to be based upon error, for at that time I was able to work with an accuracy far below 0.1°, and the total apparatus which I used precluded absolutely the slightest warming of the parts of the polarization apparatus, so that solely and alone the influence
688 of the temperature of the sugar solution could affect the angle of rotation and be observed" (p. 1915).

In conclusion the present writer would respectfully submit his own experimental investigation of the problem.

Although it appears preferable that critical studies of this matter should be effected by means of polariscopes and their proper appurtenances rather by saccharimeters, yet it is undoubtedly a matter of great practical importance to determine whether, or no, variations

in the specific rotatory power of sucrose—*in case such should be induced by variation of temperature*—could make their influence felt on, and could be determined by, saccharimeters.

To put this question to a most thorough test a series of determinations was made with a sample of pure sucrose. The work was carried on by Messrs. John A. Sherer, Edward Wolfbauer, Edward C. Brainerd, Dr. J. A. Deghuée, and the writer.

Two saccharimeters, the one a sensitive color, the other Schmidt & Haensch half-shade instrument, were used; all possible precautions and care were taken to insure accuracy.

Each solution was polarized at the temperature at which it was prepared, and the saccharimeter was also kept at that same temperature while the observations were being made.

The sucrose employed was most carefully prepared from a high grade of refined sugar. Its polarization was 99.98 at 20° C. This value was determined by Professor Dr. Alexander Herzfeld, Berlin, Germany, to whom a sample of this sucrose—in a glass-jar, under seal, had been forwarded.

The results secured in a dozen experiments are given in the following table:

Test No.	Reading observed on saccharimeter.	Temperature (centigrade) at which the solution was prepared and observed in saccharimeter.	Jobin's correction. (Formula: Pol. + [0.000167 N to be added to saccharimeter readings.	Polarization referred to the normal temperature 20° C.	Variation from the true value of the sucrose 99.98.
1	99.90	23.0°	0.04795	99.95	—0.03
2	99.85	24.5°	0.07189	99.92	—0.06
3	99.90	25.0°	0.07992	99.98	0.00
4	99.90	25.7°	0.09110	99.99	+0.01
5	99.85	25.7°	0.09106	99.94	—0.04
6	99.90	26.5°	0.10389	100.00	+0.02
7	99.85	27.0°	0.11183	99.96	—0.02
8	99.90	27.5°	0.11988	100.02	+0.04
9	99.85	29.0°	0.14378	99.99	+0.01
10	99.85	30.0°	0.15976	100.01	+0.03
11	99.80	31.7°	0.18682	99.99	+0.01
12	99.80	33.0°	0.20758	100.00	+0.02

689 Accepting Professor Herzfeld's figure 99.98, as the true polarization of this sucrose at 20° centigrade, it will be seen that the polarization determined at the temperatures given—ranging from 23° C. to 33° C.—vary by only a few hundredths of a degree Ventzke.

Placing the limit of accuracy attainable on each of the saccharimeters used, the one a color—the other a ha-f-shade instrument, at 0.10° Ventzke, it will be noted that with one single exception (test

No. 2), the variation from the accepted standard value is *less than one half of a tenth degree Ventzke.*

The average of all the twelve polarizations referred to the normal temperature of 20° centigrade is 99.98, a figure identical with Professor Herzfeld's value, although the individual polarizations from which this average value has been drawn, were determined at a dozen different temperatures, extending over a range of ten degrees centigrade.

This would seem to be satisfactory evidence and sufficient to establish the conclusion that—Jobin's correction being applied—solutions of a pure sucrose prepared at various temperatures and polarized at the temperatures at which they have been prepared, will return identical polarizations.

Confirmatory evidence of the justice of this claim has furthermore been secured by the writer by means of a very sensitive and accurate double-wedge compensation saccharimeter, a half-shade instrument, built to order by Julius Peters, of Berlin.

This saccharimeter was examined and certified to as correct by Professor Dr. A. Herzfeld, director of the Chemisches Laboratorium, *Verein der Deutschen Zucker-Industrie.*

One of the special and, it is believed, unique features of this instrument is the device whereby its quartz wedges are mounted without wax or cement; they are held in place by delicate plates and plate-springs and thus escape all danger of stress which may be induced by variations of temperature and which may lead to very serious errors in the results obtained in such instruments (see Herzfeld, Ueber den Einfluss der Temperatur auf die Angaben der Saccharimeter. *Zeitschrift des Vereines der Deutschen Zucker-Industrie,* 1899, Tech. Theil, pp. 1–20, and Wiechmann, The Optical Behaviour of Quartz under Stress. School of Mines Quarterly, 1899, pp. 267–279).

All of the weighings of the sugars examined in this investigation were made on a correctly adjusted and delicate analytical balance, indicating tenths of a milligramme.

The sugar solutions were all prepared in Mohr flasks which had been carefully standardized; these solutions were always made up at the temperature indicated by a Schmidt & Haensch thermometer (range 8° C. to 34° C., divided into tenths of a degree), which had been kept in the trough of the saccharimeter for at least twenty-four hours prior to and up to the time the polarizations were made.
690 The temperature thus indicated was accepted as representing the temperature of the saccharimeter.

The temperature of the room in which all the work was done, that is to say, in which the sugars where weighed, the solutions prepared and polarized, was always indentical with, or, at least, in very close agreement with the temperature of the saccharimeter.

The source of light was in all instances the same. It was furnished by a Hink flat triple-burner for gas. The light passed through a plane glass disk in the lamp cylinder and then through 30 millimeters of a solution of potassium dicromate—strength 6 per cent.—before it entered and traversed the sugar solution under observation.

All of the work in this investigation was done by, or under the immediate supervision and control of, the writer. To his able assistant, Mr. James Kelly, he would here express his appreciation and thanks for valuable services rendered.

All readings were taken by two observers.

In some instances the *first* reading of each observer was discarded; with this exception, *every* reading obtained has been recorded and the results reported are the actual means of *all* observations secured.

Correction for the alteration in value of the quartz-wedges of the saccharimeter, caused by alteration in temperature, has been effected by Jobin's formula.* Pol.: $+ [0.00016\ T]\ N$.

Before proceeding with an experiment the exact state of adjustment of the saccharimeter was always ascertained by means of the control-wedge of the instrument, by means of standard quartz plates kept at the same temperature as a saccharimeter, or by both of these devices.

In every instance the rotary values of the respective sugars examined were, at different temperatures, practically identical. Thus one of them showed at:

17.5° C. a polarization of 99.96° V.
22.0° C. " " " 99.94° V.

Another exhibit at:

20.0° C. a polarization of 99.79° V.
23.0° C. " " " 99.98° V.

A third sample, which, when examined in the saccharimeter with which all these tests were made, showed a polarization of 99.61° Ventzke at a temperature of 26.6° C., returned the identical polarization at a temperature 33.3° C., when independently examined by another observer and in another saccharimeter, the adjustment of which had been controlled by means of the former instru-
691 ment.

To illustrate the character of the work done, there shall be recorded *in detail* the results obtained with one of the sugars examined.

This particular sample was prepared by washing one kilogramme of a high grade refined sugar with two kilogrammes of absolute ethyl alcohol, the sugar being then dried for 24 hours as a temperature between 57.0° C. and 60.0° C.

This sugar was examined for the presence of raffinose, and the *absence* of this substance was established, as appears from the data obtained:

Direct polarization	99.57
Polarization after inversion	99.63

* *Zeitschrift des Vereins fur Ruben-zucker Industrie 1898* (p. 835.)

This sugar was subject to a most careful gravimetric examination for invert sugar. Twenty (20.0) grammes of the sugar were used in this determination, and 0.04 per cent. of invert sugar were found.

Determinations of the polarization of this sugar were made at 21.5° C., 26.0° C., 27.5° C., 30.5° C., 32.5° C.

The data obtained were the following:

No. I.

Sugar-solution prepared at	21.5° C.
Temperature of saccharimeter during observations	21.5° C.
Temperature of solution during observations	21.5° C.

Reading on solution by:

W.	K.
99.50	99.50
99.50	99.20
99.40	99.45
99.50	
Mean 99.475	99.483

Meaning of all readings taken	99.48
Saccharimeter too low	0.05
Jobin's correction	.02
Polarization of solution at 21.5° C. =	99.55

692 No. II.

Sugar-solution prepared at	26.0° C.
Temperature of saccharimeter during observations	26.0° C.
Temperature of solution during observations	26.0° C.

Readings on solution by:

W.	K.
99.45	99.50
99.50	99.50
99.45	99.45
99.40	99.50
99.40	99.50
99.50	99.45
99.50	99.45
Mean 99.46	99.48

Mean of all readings taken	99.47
Saccharimeter in perfect adjustment	0.00
Jobin's correction	0.09
Polarization of solution at 27.0 C. =	99.66

No. III.

Sugar-solution prepared at..... 27.5° C.
Temperature of saccharimeter during observations..... 27.6° C.
Temperature of solution during observation-..... 27.5° C.

Readings on solution by:

W.	K.
99.45	99.45
99.50	99.45
99.50	99.45
99.50	99.45
99.40	
99.40	
99.45	
Mean..... 99.457	99.45

Mean of all readings taken..... 99.45
Saccharimeter in perfect adjustment..... 0.00
Jobin's correction 0.12

Polarization of solution at 27.5° C. =..... 99.57

693 No. IV.

Sugar-solution prepared at..... 30.5° C.
Temperature of saccharimeter during observations..... 30.5° C.
Temperature of solution during observations..... 30.5° C.

Readings on solution by:

W.	K.
99.40	99.40
99.50	99.40
99.50	99.40
99.35	99.45
99.40	99.40
99.45	99.40
99.40	99.40
99.40	99.40
99.40	99.40
99.50	99.40
Mean..... 99.43	99.40

Mean of all readings taken..... 99.41
Saccharimeter in perfect adjustment..... 0.00
Jobin's correction 0.17

Palarization of solution at 30.5° C. =..... 99.58

No. V.

Sugar-solution prepared at..... 32.5° C.
Temperature of saccharimeter during observations..... 32.2° C.
Temperature of solution during observations..... 32.5° C.

Readings on solution by:

	W.	K.
	99.30	99.40
	99.40	99.40
	99.40	99.40
	99.40	99.40
	99.40	99.40
	99.35	99.40
	99.40	99.40
Mean.....	99.38	99.40

694 Mean of all readings taken..... 99.39
Saccharimeter in perfect adjustment..... 0.00
Jobin's correction 0.19

Polarization of solution at 32.5° C. =..... 99.58

Making a résumé of these results it appears that the polarization of this sugar obtained:

At 21.5° C. = 99.55
" 26.0° C. = 99.56
" 27.5° C. = 99.57
" 30.5° C. = 99.58
" 32.5° C. = 99.58

The limit of accuracy attainable with the excellent saccharimeter employed in these observations is probably 0.05° Ventzke.

The *maximum* difference between any two of the values found is 0.03° Ventzke.

In other words, all of the polarizations obtained under the stated conditions are virtually identical.

These results, in perfect agreement with those previously given, clearly and undeniably lead to the conclusion that, *under the practical working conditions existing in technical sugar analysis, the specific rotatory power of sucrose is a constant.*

EXHIBIT J. FOR GOV'T.

Suit 2918, Bartram Bros. *v.* U. S. and Others.

Separatabdruck aus der Zeitschrift des Vereins der Deutschen Zucker-Industrie. Bd. 51, Heft 541

Zur Frage des Einflusses der Temperatur auf die specifische Drehung des Zuckers.

Von Dr. Otto Schönrock.

Zur Frage des Einflusses der Temperatur auf die specifische Drehung der Saccharose hat in dieser Zeitschrift[1]) Herr Dr. Ferdinand G. Wiechmann, chemist, of the American Sugar Refining Co. eine längere Abhandlung veröffentlicht, in welcher er die Unabhängigkeit der specifischen Drehung des Zuckers von der Temperatur behauptet und die bisherigen Arbeiten bespricht, welche, von anderen Autoren zur Entscheidung dieser für den Zucker-
695 handel und die Steuerverwaltung ausserordentlich wichtigen Frage ausgeführt worden sind. Bei dieser Besprechung sind Herrn Wiechmann, soweit es sich dabei um meine im vergangenen Jahre in dieser Zeitschrift veröffentlichte Arbeit[2]) handelt, eine Reihe von Missverstandnissen untergelaufen, welche im Nachstehenden aufgeklart werden sollen, da ich der Ansicht bin, dass die specifische Drehung des Zuckers bei genauem Arbeiten auch für die Praxis nicht als constant betrachtet werden darf, denn nach meinen Versuchen zeigt eine Normalzuckerlösung (100° V.) pro 1° C. Temperatursteigerung durch die Abnahme der specifischen Drehung eine Abnahme der Drehung um etwa 0,002° V.

S. 917 meint Herr Wiechmann, das Erwarmen der Zuckerlösungen in der Röhre, welche ich für meine Untersuchung benutzte, müsse einen Druck auf die Deckglaschen ausgeübt haben infolge der Ausdehnung der Flüssigkeit, welche zwischen ihnen eingeschlossen war. Dies ist nicht der Fall, dem der Lösung steht beim Ausdehnen der leere Tubus A von 22 mm Durchmesser (S. 420 meiner Arbeit) zur Verfügung. Die Vermehrung des hydrostatischen Drucks um etwa 0,7 mm beim Erwarmen der Lösung ist selbstverstandlich ohne jede Bedeutung.

Was die auf S. 917 von Herrn Wiechmann herangezogenen Versuche von Degener betrifft, welcher Deckglaseinflüsse bis zu 3° Ventzke constatirt hatte, so verweise ich auf S. 425 meiner Arbeit: die Drehung der leeren Röhre mit den Deckglasern betrug im Durchschnitt etwa + 12", d. i. 0,010 Grad Ventzke, wahrend eine optische Drehung der benutzten Wassersorten nie mit Sicherheit constatirt werden konnte. Da sich Drehungen unter etwa 7", d. i.

[1]) Wiechmann, Zeitschr. d. Vereins d. Deutsch. Zucker-Ind. (Techn. Theil) 50 S. 902. 1900.

[2]) Schonrock. Zeitschr. d. Vereins d. Deutsch. Zucker-Ind. (Techn. Theil) 50. S. 413. 1900.

0,006 Grad Ventzke, selbst mit meinen Beobachtungsmitteln nicht mehr sicher nachweisen liessen, so konnte nach den Ankitten der Deckglaser[1]) zumeist überhaubt nicht eine optische Activitat der selben mit Sicherheit constatirt wurden. Da ferner durch das Einfüllen der verschiedenen benutzten Wassersorten das optische Verhalten der Deckglaser nie alterirt wurde, so wird man zugeben, dass die Deckglaser beim Einfüllen der Zuckerlösungen gleichfalls ihr optisches Verhalten nicht geandert haben werden.

Für den in einem der Thatigkeitsberichte der Physikalisch-Technischen Reichsanstalt[2]) erwahnten Umstand, dass die specifische Drehung zuweilen mit der Zeit um Betrage bis zu 0,044 wuchs, ohne dass eine Verdunstung eingetreten war, will Herr Wiechmann (S. 917) ebenfalls die Deckglaser verantwortlich machen. Diese haben jedoch mit der Erscheinung nicht das Mindeste zu thun. Vielmehr habe ich langst[3]) als Grund für diese Erscheinung festge-
696 stellt, dass die Zunahme des Drehungswinkels durch den in der Zuckerlösung vorhandenen feinen Staub verursacht wird, und gezeigt, dass sich der Drehungswinkel einer staugfreien Zuckerlösung, solange nicht Pilzbildung in der Röhre eintritt, bei gewöhnlicher Zimmertemperatur selbst in einen Zeitraum von sieben Tagen noch nicht um 1/60000 seines Betragè andert.

Betreffs der von Herrn Wiechmann auf S. 918 ausgesprochenen Ansicht, aus den mit reinem Wasser angestellten Versuchen liesse sich kein Durchschnitts-Korrektionsfactor herleiten, verweise ich auf den Abschnitt 10 (S. 425 meiner Arbeit: die geringen Drehungsanderungen sind für die verschiedenen Versuche nicht nur von sehr ungleicher Grösse, sondern besitzen auch verschiedenes Vorzeichen[4]); = 1 "würde in dem Temperaturcoefficienten einen Fehler von der Grösse 0,000 003 verursachen. Hierbei ist zu beachten, dass auf S. 434 meiner Arbeit die Genauigkeit des Temperaturcoefficienten 0,000217 zu + 0,000009 angebeben ist. — Nach Herrn Weichmann hatte ich S. 421 angegeben, der Druck der beim Erwarmen sich ausdehnenden Zuckedlösungen ware so gross, das ein Herausdrigen der Lösung bei den Deckglaschen nicht verhindert werden könnte, wenn letztere durch übergeschraubte Deckel angepresst würden. Dies beruht weider auf dem Uebersehen des Umstandes, dass meine Zuckerlösungen ja gar keinen Druck durch die Erwarmung ausüben konnten. Ich habe auch mit keinem Worte angedeutet, dass dieses Herausdringen durch den Druck der sich ausdehnenden Zuckerlösung verursacht würde. Grade im Gegentheil habe ich den Nachsatz hinzugefügt: „obgleich der Lösung beim Ausdehnen der leere Tubus zur Verfügung stand". Der Herausdringen der Lösung erklart sich einfach durch capillares Kriechen, unterstützt durch den geringen constanten Druck der Flüssigkeitssaule und den Umstand, dass die Deckplatten nicht sehr fest angeschraubt werden dürfen[5]).

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[1]) Das Ankitten geschah für jede Versuchreihe von Neuem, vgl. S. 421.

[2]) Zeitschr. f. Instrumentenkunde 17. S. 180. 1897.

[3]) Zeitschr. f. Instrumentenkunde 18. S. 187. 1898.

[4]) Die beobachteten Drehungsanderungen sind = — 2,7" + 2,2", 1,1" and 1,3".

[5]) Uebrigens weist das Wortchen „zumal" (S. 421 meiner Arbeit) darauf hin, dass das Herausdringen der Losung auch bei constanter Temperatur (nach langerem Liegen der Rohre) stattfindet.

Vergegenwartigen wir uns schliesslich, von welcher Grössenordnung die optische Activitat meiner Deckglaser war. Mit einer einzigen Ausnahme (von 43") bleiben die absoluten Betrage aller durch die Deckglaser verursachten und von mir beobachteten Nullpunktsverschiebungen des Polarisations-Apparates unter 22", d. i. 0,018 Grad Ventzke. Solche Drehungen sind aber für alle diejenigen überhaupt nicht vorhanden, welche wie z. B. Herr Wiechmann mit den gewöhnlichten technischen Quarzkeil-Saccharimetern arbeiten, bei denen sich mittelst eines Nonius nur die Zehntel Ventzke ablesen lassen und etwa die 5/100 noch geschatzt werden können. Bei den spater noch zu besprechenden Versuchen des Herrn Wiechmann können demnach durch das Anschrauben der Deckplatten Nullpunktsverschiebungen um Betrage eingetreten sein, die
697 bedeutend grösser sind als in meinen Versuchen und trotzdem von ihm, selbst wenn er es versucht hatte, nicht constatirt worden waren, da sie für alle Polarisationen mit technischen Saccharimetern selbst bei sehr sorgföltiger Arbeit an der Genauigkeitsgrenze liegen. Sicherlich bleibt trotz der minimalen Nullpunktsverschiebungen der Deckglaser mein Schlussresultat (Temperaturcoefficient gleich 0,000217 + 0,000009) einwandsfrei.

Wenn Herr Wiechmann S. 918 schreibt, „keine Erklarung wird geboten betreffs der Ursachen der grossen Unterschiede in dem specifischen Drehungsvermögen der Saccharoseproben", so hat er die Anmerkung 1 (S. 426 meiner Arbeit) übersehen. Wie im Abschnitt 11 angegeben, wurden die zwölf Versuche mit zehn nach Herkunft, oder Reinigung, oder Trocknung verschiedenen Zuckersorten ausgeführt[1]). Drei durch das Trocknen im erhitzten Trockenschrank verunreinigten Zuckersorten mit den specifischen Drehungen 66,3, 66,4 und 65,8 stehen sieben Zuckersorten gegenüber, deren specifische Drehungen zwischen 66,47 und 66,58 liegen. Bezüglich des Temperaturcoefficienten Stimmen aber auch die im schrank getrockneten Sorten mit den übrigen merklich überein. Zieht man z. B. nur die sieben Versuche mit den reinen Zuckersorten in Rechnung[2]), so ergiebt sich im Mittel der Temperaturcoefficient zu 0,000 219, wahrend aus allen 12 Versuchen das Resultat 0,000217 + 0,000 009 berechnet wird. Der Versuch mit der vereinigten Kuckersorte, deren specifische Drehung 65,8 war, ergab den Temperaturcoefficient zu 0,000 220, also war trotz des Vorhandenseins von die specifische Drehung schon merklich beeinflussenden fremden Substanzen der tempe-aturcoefficient ungeandert geblieben. Die von Herrn Wiechmann S. 919 ausgesprochenen Befürchtungen. der Temperaturcoefficient sei durch Unreinheiten im Zucker verursacht, sind mithin gerade durch meine Versuche schlagend widerlegt.

Herr Weichmann führt bei seinen experimentellen Untersuchungen, welche er am Schluss seiner Betrachtungen S. 930—936 mitt-

[1]) Nur zu den ersten drie Versuhcen diente ein und dieselbe Zuckersorte, von welcher drei verschiedene Losungen im Mittel specifische Drehungen ergaben, deren grosste Abweichung untereinander 0,014% betragt, was eine genugende Uebereinstimmung sein durfte.

[2]) Diese reinen, nicht etwa die drei unreinen Zucker haben unbrigens die aussersten beobachteten Grenzwerthe fur den Temperaturcoefficienten geliefert.

heildt, die Polarisationen und überhaupt alle Arbeiten bei Zimmertemperaturen von 21° bis 33° aus, und zwar nach Arbeitsmethoden, deren zufällige Fehler[1] ganz bedeutend grösser als die meinen sind. Seine Beobachtungen müssen ausserdem mit systematischen Fehlern behaftet gewesen sein. So findet z. B. das mit steigender Zimmertemperatur zunehmende Verdunsten des Wassers aus der Zuckerlösung keinerlei Berücksichtigung. Dass hierdurch
698 betrachtliche Fehler entstehen, wird man zugeben, wenn man bedenkt, dass die durch die Abnahme der specifischen Drehung pro Grad Temperatursteigerung bedingte Drehungsabnahme einer Normalzuckerlösung (100° V.) um 0,0217° V. bereits vollkommen aufgehoben werde würden, sobald pro Grad steigender Zimmertemperatur von der in der Polarisationröhre enthaltenen Zuckerlösung von etwa 11 g (dieser Werth dürfte der Wirklichkeit sehr nahe kommen) während des Einfüllens in's Rohr und der Zeit bis zum Beginn der Ablesungen am Saccharimeter nur 2,2 mg Wasser mehr verdunsten.

Zum Schluss seiner Arbeit drückt sich Herr Wiechmann dahin aus, dass das specifische Drehungsvermögen der Saccharose unter den thatsachlichen Bedingungen der technischen Zuckeranalyse constant sei. Leider unterlasst er anzugeben, welchen Betrag die durch jene, „thatsachlichen Bedingungen" hervorgerufenen systematischen Fehler bei seinen Polarisationen erreichen konnte. Ich bin daher trotz der gegentheiligen Ansicht des Herrn Wiechmann auch jetzt noch der bereits Eingangs dieser Zeilen zum Ausdruck gebrachten Meinung, das bei sorgfaltigem Arbeiten auch für die Praxis die specifische Drehung des Zuckers nicht als constant zu betrachten ist.

Bei dieser Gelegenheit möchte ich nicht unterlassen, die richtige Anwendung des Temperaturcoefficienten 0,000 217 an einem in der Praxis wohl haufig vorkommenden Biespiel zu erlautern. Bekanntlich is von der dritten Versammlung der internationalen Commission für einheitliche Methoden der Zuckeruntersuchungen in Paris am 24. Juli 1900 die folgende Definition des Hundertpunkts der Ventzke'schen Scale einstimmig angenommen worden: der Hundertpunkt der Saccharimeter wird erhalten, indem man die Normalzuckerlösung, welche bei 20° C. in 100 ccm ein ccm gleich dem Volumen von 1 g Wasser von 4° im luftleeren Raum abgewogen 26,000 g reinen Zucker in Luft mit Messinggewichten gewogen enthalt, bei 20° im 20-cm-Rohr in Saccharimeter polarisirt. Es wird nicht schwer fallen, mit Hülfe eines Wasserbades beim Auffüllen in Messkölbchen bis zur Marke die Normaltemperatur 20° innezuhalten und somit die Normalzuckerlösung richtig herzustellen. Schwieriger dagegen dürfte es sein, die letztere nun auch immer bei 20° im Saccharimeter, dessen Quarzkeilcompensation gleichfalls die Temperatur 20° haben muss, zu palarisiren, sobald, die Temperatur des Arbeitzimmers nicht constant auf 20° erhalten wird. Das Arbeitszimmer habe in der Nahe des Sacchar-

[1]) Die zufalligen Fehler sind diejenigen, welche durch die eigentliche Unsicherheit der Beobachtungen entstehen.

imeters die Temperatur t und zwar seit geraumer Zeit, so dass man annehmen kann, dass die den Schwankungen der Zimmertemperatur nur sehr langsam folgende Temperatur der ziemlich dicken Quarzkeile und Compensationsplatten auch t° ist. Dann wird nach kürzerem Liegen der Röhre im Saccharimeter auch die zu polarisirende Normalzuckerlösung ($^{20} = 100°$ V.) die Temperatur t annehmen. Die Polarisation ergebe die Ablesung ^{t} in Graden Ventzke, so ist bekanntlich ^{t} kleiner als ^{20}, wenn t über 20° liegt.

699 Wir wollen jetzt die Differenz $^{20} - {}^{t}$ berechnen. Zu dem Zweck hat man die Temperaturcoefficienten aller sich andernden Grössen mit den richtigen Vorzeichn versehen zu addiren und zu beachten, dass sich mit der Temperatur der Hundertpunkt der Saccharimeters und die Drehung der Zuckerlösung andert. Somit hat man:

Aenderung des Hundertpunkts des Saccharimeters

+ 0,000 143 Temperaturcoefficient der Drehung des Quarzes einschliesslich der Ausdehnung parallel zur Achse,

— 0,000 013 Ausdehnungscoefficient des Quarzes senkrecht zur Achse,

+ 0,000 018 Ausdehnungscoefficient der Nickelinscala,

112 Schonrock, specifische Drehung des Zuckers.

Drehungsänderung der Zuckerlösung

$$\left\{ at = \frac{[a]\,t\,l\,t\,c\,t}{100} \right\}$$

+ 0,000 217 Temperaturcoefficient der specifischen Drehung des Zuckers[1]),

— 0,000 008 Ausdehnungscoefficient der Glasröhre,

+ 0,000 291 + 0,000 0066 $\frac{t-20}{2}$ Ausdehnungscoefficient der Normal zuckerlösung[2]),

und erhält durch Addition

+ 0,000 648 + 0,000 0033 (t—20). Mithin ist

$$^{20} - {}^{t} \Big\} 0{,}000\ 648 + 0{,}000\ 0033\,(t-20) \Big\} (t-20) \text{ und}$$

$$^{20} = {}^{t} + {}^{t}\,0{,}000\ 648\,(t-20 + {}^{t}\,0{,}000\ 0033\,(t-20)^2.$$

Natürlich behält diese Gleichung ihre Giltigkeit, auch wenn t kleiner als 20 ist.

Stellt man also die Normalzuckerlösung bei 20° her, polarisirt dieselbe aber bei t° in einem Saccharimeter, dessen Keilcompensation gleichfalls die Temperatur t besitzt, so genügt es, wenn t nahe bei 20° liegt, immer, zu der in Graden Ventzke gefundenen Ablesung die Grösse 0,065 (t—20) hinzuzuaddiren, um den wirklichen Hundertpunkt des Saccharimeters bei 20° zu eshalten.

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[1]) Derselbe ist bis jetzt von mir nur fur Natriumlicht bestimmt worden; es ist aber sehr wahrscheinlich, dass er bei geringen Temperatur-Differzenen fur alle Lichtarten giltig bleibt.

[2]) Derselbe andert sich stark mit der Temperatur (v-l. S. 419 meiner Arbeit); wegen $\frac{t-20}{2}$ ist Gleichung 9) (S. 420) zu beachten.

700 EXHIBIT J–1 FOR GOV'T.

(*Translation of Exhibit J.*)

Suit 2918, Bartram Bros. *v.* U. S. and Others.

From the Zeitschrift des Vereins der Deutschen Zucker-Industrie, vol. 51, number 541, February, 1901.

Technical part, pp. 105 *et seq.*

On the Question of the Influence of the Temperature on the Specific Rotation of Sugar.

By Dr. Otto Schonrock, Translated by Dr. H. W. Wiley.

Dr. Ferdinand G. Wiechmann, chemist of the American Sugar Refining Company, has published in this journal (volume 50, page 902), a lengthy article in which he asserts that the specific rotation of sugar is independent of temperature, and discusses the previous investigations which have been carried out by other authors for the determination of this question which is so extraordinarily important in the sugar trade and for the levying of duties. In this discussion Dr. Wiechmann in so far as he treats of my work published last year in this journal (vol. 50, page 413), has fallen into a series of misconceptions which will be explained in the following, since I am of the opinion that the specific rotation of sugar in exact work even in practice, should not be regarded as constant, for according to my experiments a normal sugar solution (100° V) shows by reason of the decrease of the specific rotatory power a decrease of rotation of about 0.022° V. for each 1° C. of rise in temperature. On page 917 Mr. Wiechmann intimates that the warming of the sugar solution in the tube which I use for my research must have exerted a pressure on the cover glasses in consequence of the expansion of the liquid which was enclosed between them. This is not the case since the empty tube A of 22mm diameter (page 420 of my article), during expansion is at the disposition of the solution. The increase of the hydrostatic pressure of about 0.7 mm during the warming of the solution is self evidently without any significance.

In regard to the experiments of Degener, referred to by Mr. Wiechmann on page 917, who has established a maximum variation of 3° Ventzke by reason of the influence of the cover glasses, I refer to this on page 425 of my article; the rotation of the empty tube with the cover glasses amounted on the average to about + 12″ that is 0.010° Ventzke while the optical rotation of the different kinds of water used could never be determined with certainty. Since rotations under about 7″ that is 0.006° Ventzke even with my
701 means of observation could no longer be detected with certainty, so after the luting on of the cover glasses (the luting was repeated for each series of experiments, see page 421, vol. 50, this

journal) in general the optical activity thereof could not be determined with any certainty. Further, since by filling with the different kinds of water used the optical deportment of the cover glasses was never altered so must it be granted that the cover glasses by filling with sugar solutions have likewise not changed their optical deportment.

Dr. Wiechmann likewise (page 917) holds the cover glasses responsible for the circumstance mentioned in one of the reports of the Physical-Technical Imperial Institute (Zeitschrift fur Instrumentenkunde, vol. 17, page 180, 1897), that the specific rotation of the solution on standing sometimes increases to a maximum of 0.044 without having suffered any evaporation. The cover glasses have, however, not the least to do with this phenomenon, on the contrary I have long since determined the reason for this phenomenon (Zeitschrift fur Instrumentenkunde, vol. 18, page 187, 1898), namely, that the increase of the rotation angle is caused by the fine dust which is present in the sugar solution, and I have shown that the rotation angle of the dust-free sugar solution, so long as the formation of mold in the tube does not take place, at ordinary room temperature is not changed by 1/60,000 of its value in a period of 7 days. In so far as the view taken by Mr. Wiechmann on page 918 is concerned, that no mean correction factor could be derived from experiments carried out with pure water, I refer to this in section 10 (page 425) of my article; the small rotation changes are, for the different experiments, not only of very unequal magnitude but possess also different signs (the observed rotation changes are 2.7″, 2.2″, 1.1″ and 1.3″);

1″ would cause in the temperature co-efficient an error of the magnitude 0.000,003. In this connection it is to be observed that on page 434 of my article the accuracy of the temperature coefficient 0.000,217 is given to ± 0.000,009. According to Mr. Wiechmann I have stated on page 421 that the pressure of the expanding sugar solution during warming was so great that the exudation of the solution at the cover glasses could not be prevented, even if they were held by a cover screwed down upon them. This misconception rests again upon the oversight of the circumstance that my sugar solution could not exert any pressure at all during warming. I have not by a single word indicated that this exudation was caused by the pressure of the expanding sugar solution. Exactly to the contrary I have added an explanatory phrase: "Although the empty tube was at the disposition of the solution during expansion." The exudation of the solution is explained simply by capillary crawling, supplemented by the very small constant pressure of the column of liquid and the circumstance that the cover glass plates should not be very firmly screwed down. (Moreover the word "zumal"
702 page 42 of my article refers to the fact that the exudation of the solution takes place also at a constant temperature after long lying of the tube.)

Let us consider finally of what magnitude the optical activity of my cover glasses was. With a single exception (of 43″) the absolute amounts of the displacement of the zero point of the polariza-

tion apparatus observed by me and caused by the cover glasses remain below 22″, that is 0.018° Ventzke. Such rotations, however, do not exist for all those who, as for example Dr. Wiechmann, work with the ordinary technical quartz wedge saccharimeters on which, by means of the vernier, only the 1/10 of a degree Ventzke can be read and about 5/100° estimated. In the experiments of Mr. Wiechmann, which will be mentioned later, variations of the zero point can occur through the screwing on of the cover plates in amounts which are markedly greater than in my experiments and which could not be detected by him even if he had tried since for all polarizations with the technical saccharimeter even with the most careful work, they lie at the borders of exactness. Certainly my final result, in spite of the minimum variations of the zero point due to the cover glasses is above criticism (viz., the temperature co-efficient is equal to 0.000,217 + 0.000,009). When Mr. Wiechmann on page 918 writes "No explanation is offered in respect of the causes of the great differences in the specific rotatory power of the samples of sugar," he has overlooked note 1 (on page 426) of my article. As given in section 11, the 12 experiments were carried out with 10 kinds of sugar differing according to origin, or purification, or drying. (One and the same sugar served only for the first three experiments of which three different solutions gave on the average a specific rotation of which the largest variation amounted to less than 0.014 per cent. which should be a sufficient agreement.) Three samples of sugar rendered impure by drying in a hot drying oven with specific rotations of 66.3, 66.4 and 65.8, stand in comparison with 7 samples of sugar whose specific rotations lie between 66.47 and 66.58. In respect of the temperature co-efficient, however, the samples dried in the drying oven, agree with the others in a marked manner.

If we take into consideration for example only the 7 experiments with the pure samples of sugar. (These pure sugars rather than the three impure sugars have given the extreme abnormal limits for the temperature co-efficient.) The mean value of the temperature co-efficient is 0.000,219 while if calculated from all 12 experiments the result is 0.000,217 + 0.000,009. The experiments with the impure sugar sample of which the specific rotation was 65.8 gave a temperature co-efficient of 0.000,220, thus has the temperature co-efficient remained unchanged in spite of the presence of foreign substances markedly influencing the specific rotation. The apprehensions mentioned by Mr. Wiechmann on page 919 that the temperature co-efficient was produced by impurities in the sugar have therefore been proved thoroughly groundless by my experiments.

703 Mr. Wiechmann in his experimental researches, which he gives at the end of his observations (pages 930-936), performs the polarizations and generally all of his work, at room temperatures from 21° to 33°, and furthermore according to working methods the accidental errors of which are very much greater than mine. (The accidental errors are those which arise from the actual uncertainty of the observations.) His observations must furthermore be burdened with systematic errors. For instance, no regard is

paid to the increasing evaporation of the water from the sugar solution with increasing room temperature. It is at once evident that important errors arise from these causes when we remember that the decrease in the rotation of the normal sugar solution (100° V.) of 0.0,217° V., through the decrease of the specific rotation for 1° of rise of temperature could be completely neutralized as soon as for each degree of rising room temperature the 11 grams of the sugar solution contained in the polarization tube (this weight comes very near the actuality) should lose by evaporation only 2.2 mg. of water during the filling of the tube and during the lapse of time to the beginning of the reading of the saccharimeter. At the close of his article Mr. Weichmann expresses the opinion that the specific rotation of saccharose under the actual conditions of technical sugar analysis is constant. Unfortunately he omits to state what magnitude the systematic errors, produced by those "actual conditions," can reach in his polarizations. I am, therefore, in spite of the opposite opinion of Mr. Weichmann, still of the opinion, expressed already at the beginning of these lines, that in careful work, even for practice, the specific rotation of sugar cannot be regarded as constant. At this opportunity I ought not to omit to explain the proper use of the temperature co-efficient 0.000,217 by an example commonly occurring in practice. It is known that at the third meeting on the International Commission for the Unification of Methods of Sugar Analysis held in Paris, on the 24th of July, 1900, the following definition of the 100 point of the Ventzke scale was unanimously adopted, viz:

The 100 point of the saccharimeter is obtained by polarizing, in a 20 cm tube in a saccharimeter at 20° C., the normal sugar solution, which contains at 20° C. in 100 cc (one cc is equal to the volume of one gram of water at 4° weighed in vacuo) 26 grams of pure sugar weighed in air with brass weights.

It will be difficult with the help of the water bath to maintain the normal temperature of 20° in the filling of the measuring flask to the mark and thus to properly prepare the normal sugar solution. On the contrary it will be more difficult to polarize the latter always at 20° in a saccharimeter whose quartz wedge compensation must likewise have a temperature of 20° when the temperature of the working room is not kept constant at 20°. Let the working room near the saccharimeter have a temperature of t, and indeed for a long time, so that it can be assumed that the temperature of the tolerably thick quartz wedge compensation plates, following only very
704 slowly the variations of the room temperature, is also t. Then after a short lying of the tubes in the saccharimeter the normal sugar solution to be polarized (20=100° V.) will also have the temperature t. Let the polarization give the reading t in degrees Ventz-e so it is evident that t is smaller than 20, if t is greater than 20°. We will now calculate the difference $20-t$. To this end it is necessary to add the coefficients of all the changing magnitudes with the proper sign and to observe that the 100 point of the saccharimeter and the rotation of the sugar solution change with the temperature. Thus we have:

Change of the 100 point of the saccharimeter.

+ 0.000 143 Temperature coefficient of the rotation of the quartz including the expansion parallel to the axis.

— 0.000 013 Expansion coefficient of the quartz perpendicular to the axis.

+ 0.000 018 Expansion coefficient of the nickel scale.

Change in rotation of sugar solution.

$$(\mathrm{d}t = \frac{(\mathrm{d})\mathrm{t}\quad 1\quad \mathrm{t}\,\mathrm{ct}}{100})$$

+ 0.000 217 Temperature coefficient of the specific rotation of sugar. (This has so far been determined by me only for sodium light; but it is very probable that it remains applicable for small temperature differences to all kinds of light.)

— 0.000 008 Expansion coefficient of the glass tube.

$+ 0.000\,291 + 0.000\,0066\,\frac{t-20}{2}$ Expansion coefficient of the normal sugar solution. (This changes decidedly with the temperature (see page 419 of my paper); on account of $\frac{t-20}{2}$ formula 9 (page 420) must be observed.)

We get by addition

$+ 0.000\,643 + 0.000\,0033\,(t-20)$. And consequently $20 - t - t$
$0.000\,648 + 0.000\,0033\,(+20\,(t-20)$ and $20 - t + t$
$0.000\,648\,(t-20) + t \quad 0.000\,0033\,(-20.)$

Of course this formula maintains its validity also if t is smaller than 20.

If the normal sugar solution is prepared at 20° but polarized at t° in a saccharimeter whose quartz compensation likewise has temperature t it is sufficient if t lies near 20°, always to add to the reading found in Ventzke degrees the quantity $0.065\,(t-20)$ in order to obtain the real 100 point of the saccharimeter at 20°.

705 Ex. K for Gov't.

Suit 2918, Bartram Bros. *v.* U. S. and Others.

Chemisches Laboratorium des Vereins der Deutschen Zucker Industrie.

Telephon-Anschluss Amt III, No. 2434.

Berlin N. 4, Invalidenstrasse 42,
Portal 8 den 13. *April*, 1901.

Herrn H. W. Wiley, chief of the United States Department of Agriculture, division of chemistry, Washington, D. C.

Geehrter Herr Wiley!

Mit grossem Bedauern habe ich aus Ihrem Schreigen vom 21. v. M. ersehen, dass Sie meine Bemerkungen in dem Artikel der Vereinszeitschrift 1899, 2. Seite 1 als eine Kritik aufgefasst haben, wahrend ich absolut keinen Gegensatz habe construieren wollen und ich überhaupt Ihre Versuche nur infolge enies Missverstandnisses erwahnt habe.

Als ich meinen Artikel schrieb, kannte ich namlich nur Ihren mundlichen Vortrag auf dem Wiener Congress 1898 und konnte mich nur darauf beziehen. Erst nach Erscheinen meines Artikels im Sommer 1899 wurde von Strohmer Ihr Vortrag in der oesterreichischen Zuckerzeitschrift publiciert.

Die Ergebnisse dieses Artikels nun stimmen vollstandig mit meinen Beobachtungen überein und würde ich selbstberstandlich die Bemer kung gar nicht gemacht haben, wenn Ihr Artikel eher erschienen ware.

Es liegt also in der That augenscheinlich ein Missverstandnis vor, was lediglich dadurch verursacht ist, dass Ihr Referat so ungewöhnlich spat im Druck erschienen ist.

Mit besten Grussen
Ihr
ergebenster
A. HERZFELD.

U. S. Dept. of Agriculture
Received
Apr. 26 1901
Division of Chemistry
U. S. Dept. of Agriculture
Answered
Apr. 29 1901
Division of Chemistry

706 EX. K 1. FOR GOV'T.

(*Translation of Exhibit K.*)

Suit 2918, Bartram Bros. *v.* U. S. and Others.

Translation of a letter from Dr. Alexander Herzfeld, dated Berlin No. 4, Invalidenstrasse 42, portal 8, April 13, 1901.

Mr. H. W. Wiley, chief of the division of chemistry, U. S. Department of Agriculture, Washington, D. C.

DEAR MR. WILEY: It is with great regret that I learn from your letter of the 21st of March that you have regarded my remarks in the article of the journal of the Vereins for 1899, 2, p 1, as *as* critique, while I absolutely have not desired to raise any objection and, moreover, have mentioned your experiments only in consequence of a misunderstanding.

When I wrote my article, I had only your oral address before the Vienna congress of 1898, and could only refer thereto. It was after the appearance of my article that your address was published by Strohmer, in the summer of 1899, in the Austrian sugar journal. The data of this article agree completely with my observations and it is self-evident that I would not have made the remark if your article had appeared earlier. It is evident, therefore, that it is a case of misunderstanding which was caused solely by the fact that your abstract was published so unusually late.

With best greetings, I am,

Most respectfully, A. HERZFELD.

EXHIBIT L FOR GOV'T.

Suit No. 2918.

Bartram Bros. *vs.* U. S. and two others.

Remarks on the Foregoing Paper by Dr. Wiechmann.

By Dr. Otto Schönrock.

Professor Herzfeld was kind enough to bring to my attention the foregoing reply by Mr. Wiechmann while it was in press. I believe it to be useless to enter into a renewed detailed discussion because the objections of Mr. Weichmann again rest upon misunderstandings on his part as is plainly to be seen by every careful reader of my papers from the following three short notes:

1. In regard to the cover glasses "luted upon the glass tubes."

I refer again to part 10 "Investigation of polarization tubes
707 filled with pure water at different temperatures," of my paper (this journal, 1900, page 425) and to my remarks, pages 107 and 108 of this journal, 1901.

2. In regard to the dust question.

I do not need to enter more minutely into the remarks of Mr. Wiechmann since he himself explains in regard to this "dust" question that he is "not able to reach a proper understanding" because

he has not read my paper relating to it. Moreover the investigations described in my paper of 1900 are self-evidently made with dust free sugar solutions.

3. In regard to my objection to Mr. Weichmann's experiments, that with "rising temperature" the evaporation of the water increases. I have on page 109 of this journal, 1901, clearly expressed that by working, for example at 33° more water will be evaporated from the sugar solution than if the work is conducted at 21°; "by keeping the temperature constant for hours at a time" the evaporation of water is of course not prevented.

EX. 1 FOR IMPORTERS.

Suit 2918.

Bartram Bros. *vs.* U. S. and two other suits.

Sugar Certificate.

G. Grund, analytical chemist.

Laboratory for sugar analysis, No. 121 Front street.

NEW YORK, *Feb.* 11, 1901.

Mr. John A. Sherer:

I hereby certify that I have examined the sample of "sugar" marked as below and find it to contain as follows:

Ex. #1.

Mark.	Cane sugar, percentage.
At 17½° Celsius.	
99.90.99.90.99.90.99.95.99.95.99.95.	
At 25° Celsius.	
99.85.99.85.99.90.99.85.99.85.99.85.	
At 30° Celsius.	
99.85.99.85.99.85.99.85.99.85.99.85.	
17.5	99.925
25	99.86
30	99.85

G. GRUND.

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EX. 2 FOR IMPORTERS.

Suit No. 2918.

Bartram Bros. *vs.* U. S. and other suits.

S. P. Sharples, chemist, 13 Broad street.

BOSTON, MASS., *February* 4, 1901.

To Dr. Ferdinand G. Wiechmann.

DEAR SIR: Please find below tests of the sample of sugar left at my office by you on Friday last.

This test was made on a C. Scheibler color instrument. The in-

strument was carefully tested at each temperature by a quartz plate which many carefully conducted tests have shown to test 99.3.°. The test in each case was made with the instrument which had been kept for at least three hours at the temperature of the test. The water used in making up the solution was at the same temperature as the instrument. The flask used in making up the solutions holds 100 grams of water at 15.5° C.

The process we have used in the above tests is exactly the same process that we have used for the last twenty years in all commercial tests.

Test #1, 17° C.		Test #2, 25° C.		Test #3, 30° C.	
Quartz plate.	Solution.	Quartz plate.	Solution	Quartz plate.	Solution.
99.35	99.8	99.4	99.75	99.35	99.50
99.40	99.8	99.45	99.80	99.20	99.55
99.45	99.8	99.35	99.70	99.20	99.50
99.45	99.85	99.40	99.80	99.35	99.55
99.40	99.8		99.70	99.20	99.45
				99.35	99.58
99.40	99.81	99.40	99.75	99.30	99.48
Correction	9.10	Correction	0.10	99.30	99.50
True reading	99.71		99.65	99.28	99.51
				Correction	0.02
					99.53

Yours respectfully, S. P. SHARPLES.

The above tests were made by F. W. Bennett.

709 EX. 3 FOR IMPORTERS.

Suit No. 2918.

Bartram Bros. *v.* U. S. and other suits.

PHILADELPHIA, *February 8th*, 1901.

Mr. Jno. A. Sherer, 122 Front street, New York.

DEAR SIR: I have carefully tested the sample of refined sugar received from you by express on the 25th inst., sealed and marked No. 4, with the following results:

At 17.5. C.		At 25. C.		At 30. C.	
Quartz plate.	Solution.	Quartz plate.	Solution.	Quartz plate.	Solution.
1	99.8		99.8		99.7
2	99.7		99.7		99.6
3	99.7		99.6		99.6
4	99.8		99.7		99.7
5	99.8		99.6		99.6
6	99.8		99.7		99.6
Average	99.76		99.68		99.63

The above tests were made on a correctly adjusted Schmidt & Haensch polariscope, which was in perfect agreement with a quartz plate previously tested by the U. S. Coast & Geodetic Survey, Washington, D. C., and found correct within 0.01 of one degree. A 100 c. c. Mohr flask was used, graduated at 17.5.C.

At the time of making the tests the polariscope had remained at the temperature indicated for six hours at least. The water used in making the solutions was of uniform temperature with the room and the polariscope.

The method pursued in making the tests was the same I have followed in testing for commercial purposes, and for the U. S. Government during the past 23 years.

Yours truly, G. LANDSMANN.

EX. 4. FOR IMPORTERS.

Suit No. 2918.

Bartram Brothers *v.* U. S. and other suits.

NEW YORK, *February 8th*, 1901.

Mr. John A. Sherer, 122 Front street, New York city.

DEAR SIR: Below please find report of results of the tests of sample of refined sugars received from you on the 2d instant in two bottles, sealed, and marked Nos. 1 and 2. Three separate tests of the samples (which were identical) were made at each of the following temperatures, viz.: 17.5 C., 23. C. and 25.5 C. and the average results were as follows:

At 17.5 C., 99.75
" 23.0 C., 99.65
" 25.0 C., 99.55

710 The tests were made on a Schiebler color instrument in correct adjustment, which was carefully tested at each temperature by a quartz plate previously tested for accuracy, and known to be correct. Several readings were made at the different temperatures and the mean taken. In each case the polariscope had remained at the specified temperature for at least 1¾ hours. The solutions were made up in a Mohr flask of 100 c. c., and both the room and the solutions were of the same temperature as the instrument.

The operations were conducted by me in the same manner in which I have been making commercial tests for the past 16 years.

Yours truly, M. HASENCLEVER,
Manager for A. Weichert.

EX. 5 FOR IMPORTERS.

Suit No. 2918.

Bartram Bros. *vs.* U. S. and other suits.

NEW YORK, *February 13th*, 1901.

Mr. John A. Sherer, 122 Front St., New York city.

DEAR SIR: The results of tests made by me of a sample of refined sugar sealed and marked No. 7, received from you on the 11th inst. are as follows:

	At 17.5 C.	At 25.0 C.	At 30.0 C.
1	99.80	99.70	99.70
2	99.80	99.70	99.70
3	99.80	99.80	99.70
4	99.80	99.80	99.70
5	99.80	99.80	99.70
6	99.80	99.70	99.70
7			
8			
Average	99.80	99.75	99.70

The instrument used was a new half shade double scale compensation saccharimeter of extreme sensitiveness, made to order by Julius Peters of Berlin, and examined and certified by Prof. Dr. A. Herzfeld, which was also tested by me at zero, and at four different points of the scale by standard quartz plates. The flask used was a correct Mohr flask of 100 c.c. with the normal weight of 26.048 grams.

The instrument, the water used in making up the solution, and the room were of the same temperature as indicated for each series of tests.

In each case the saccharimeter had remained at the required temperature at least two hours.

The method pursued in making the above tests was the same as used by me during 8 years testing sugars for commercial purposes, and 17 years for the United States Government.

Yours truly, EDMUND SHERER.

Ex. 6 for Importers.

SUIT No. 2918.

Bartram Bros. vs. U. S. and other suits.

IMPORTATIONS OF REFINED SUGAR.

New York,——————189

Importer.	Vessel.	Where From.	Date of Entry.	Date of Shipment.	Marks.	No. of Packages.	Character of Product	Color D. S.	Rate of Duty.	Appraised Value.	Remarks.
Acker M. & C.	Patricia	Germany	7/3			50	Ref.			100.00	July 15, 1899
Fellows & Sparks	Glanton	Austria	11/28			400	Crystals			99.90	Nov. 17, "
Fellows & Sparks	Glanton	Austria	11/28			400	Crystals			99.90	Nov. 17, '99
Wallace, Miller & Co.	Bulgaria	Hamburg	11/29			1250	Gran			100.00	Dec. 8, '99
"	"	"	"			750	"			99.85	" " "
"	"	Austria	12/2			1000	"			99.95	" 14, '99
E. V. Skinner	"	"	12/4			500	"			99.90	" " "
Fellows & Sparks	Beltor	"	12/26			60	Ref.			100.00	Jany 4, 1900
Wallace, Muller & Co.	Graf Waldersee	"	12/27			1000	"			99.90	" " "
"	"	"	"			1000	"			100.00	" " "
Rosenstein Bros.	Pochahontas	"	1/25			100	Loaf			99.95	Feby 1, "
"	"	"	"			300	"			99.85	" 1, "
Fellows & Sparks	Glanton	"	1/30			460	Refined			100.00	" 7, "
Wallace, Muller & Co.	Bulgaria	"	12/2			1000	"			99.80	" 7, "
Rosentein Bros.	Fe'g'sii	"	2/14			400	Loaf			99.85 Austria	" 23, "
Levy, Levis & Co.	Phoenicia	"	2/20			200	"			99.95	" 27, "
Rosentein Bros.	Pennsylvania	"	2/27			100	"			99.75	Mch 2, "
"	Pretora	"	3/6			100	"			99.95	" " "
C. B. Richards & Co.	"	"	3/5			300	"			100.00	" " "
Rosentein Bros.	Pawnee	"	3/24			300	"			99.95	Apl 3, "
Fellows & Sparks	Belton	"	4/21			460	Ref.			100.00	" 28, "
Hills Bros. & Co.	"	"	"			1000	"			100.00	" " "
Wallace, Muller & Co.	Graf Waldersee	"	5/15			2000	"			99.25	May 23, "
Hills Bros & Co.	Potsdam	Holland	7/2			2000	"			100.00	July 13, "
"	Barcelona	Russia	6/21			1000	"			100.00	June 29, "

712.

1005

IMPORTATIONS OF REFINED SUGAR.

New York,.....189

Importer	Vessel	Where From	Date of Entry	Date of Shipment	Marks	No. of Packages	Character of Product	Color D. S.	Rate of Duty	Appraised Value	Remarks
Hills Bros. & Co.	Statendam	Holland	7/9			3000	Ref.			100.00	July 17 1900
"	"	"	"			2000	"			100.00	" " "
R. Crooks & Co	Bantarossa	Eng. Bremen	7/16			1661	"			100.00	" " "
Wallace, M. & Co.	Barcelona	Scotland	7/5			500	"			100.00	" " "
"	Southwark	Belgium	7/19			2240	"			99.95	" 24 "
H. L. Hobart & Co.	Pretoria	Hamburg	7/16			2500	"			99.90	" " "
"	Palatia	"	7/21			2500	"			100.00	" 27 "
Hills Bros. & Co.	Spaarndam	Holland	7/18			3000	"			99.975	" " "
"	Pretoria	Bohemia	7/16			5000	"			99.975	" " "
Wallace, M. & Co.	Buardule	Holland	"			1000	"			99.925	" 30 "
R. Crooks & Co	Caprie	Belgium	7/24			2000	"			99.95	Aug. 3 "
Hills Bros. & Co.	Rotterdam	R'dam	"			3000	"			100.00	" " "
Runkel Bros.	"	"	"			500	"			99.975	" " "
G. A. Jahn & Co.	Patricia	Germany	7/28			928	"	Russian		99.95	" 7 "
"	"	"	"			970	"	"		99.95	" " "
W. H. B. Totten & Co	"	"	7/29			1000	"	Austrian		100.00	" 9 "
Wallace, M. & Co.	"	"	"			2000	"	"		99.975	" " "
Hills Bros. & Co.	Pretoria	"	7/17			800	"	Russian		99.975	" 11 "
"	Grosser Kurfurst	"	7/30			175	"	"		99.95	" " "
"	"	"	"			1397	"	"		99.95	" " "
"	"	"	"			1755	"	"		99.95	" " "
"	Konigen Luise	"	7/12			2788	"	"		100.00	" " "
"	"	"	"			750	"	"		100.00	" " "

IMPORTATIONS OF REFINED SUGAR.

New York..... 189

Importer	Vessel	Where From	Date of Entry	Date of Shipment	Marks	No. of Packages	Character of Product	Color D. S.	Rate of Duty	Appraised Value	Remarks
Hills Bros. & Co.	Belgravia	Germany	7/16			1864	Ref.			99.975	Aug. 11 1900
"	Penna	"	7/7			1305	"			100.00	" " "
"	"	"	"			848	"			100.00	" " "
"	Patricia	"	7/28			8560	"			100.00	" " "
"	"	"	7/31			1859	"			100.001	" " "
G. A. Jahn & Co.	Graf. Waldersee	"	8/4			928	"	Russian		99.875	" 13 "
R. Crooks & Co.	Pretoria	"	7/17			600	"	"		99.925	" 15 "
"	Kensington	Belgium	8/2			2000	"	Belgium		99.975	" " "
Hills Bros. & Co.	Graf. Waldersee	Holland	8/6			3000	"	Austrian		99.95	" " "
"	Maasdam	"	7/30			1000	"	Holland		99.90	" " "
"	"	"	"			1500	"	"		99.90	" " "
"	Barbarossa	Russia	8/10			465	"	Russian		100.00	" 17 "
"	Amsterdam	Holland	8/8			1500	"	Holland		99.975	" " "
"	"	"	"			3500	"	"		99.975	" " "
"	"	"	"			1000	"	"		99.975	" " "
H. Christie	Graf. Waldersee	Germany	7/27			1040	"	Russian		100.00	" 21 "
Wallace, M. & Co.	"	"	7/18			959	"	"		99.95	" " "
Hills Bros. & Co.	Penna	"	8/17			2240	"			99.90	" 23 "
H. L. Hobart & Co.	Barbarossa	"	7/12			825	"			99.925	" 25 "
"	"	"	"			675	"			99.95	" " "
"	Barcelona	"	"			1600	"			99.975	" " "
Hills Bros. & Co.	Spaarndam	Holland	8/22			2500	"			99.925	" " "
"	"	"	"			1500	"			99.925	" " "

714.

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IMPORTATIONS OF REFINED SUGAR,

New York 189

Importer	Vessel	Where From	Date of Entry	Date of Shipment	Marks	No. of Packages	Character of Product	Color D. S.	Rate of Duty	Appraised Value	Remarks
Hills Bros. & Co.	Spaarndam	Holland	8/22			4000	Ref.			99.975	Aug. 28 1900
"	"	"	"			1500	"			99.925	" " "
"	"	"	"			2000	"			100.00	" " "
"	"	"	"			1000	"			99.975	" " "
W. H. B. Totten & Co.	Fr. de Grosse	Germany	7/31			1000	"			99.925	" 29 "
Hills Bros. & Co.	Rotterdam	R'dam	8/27			3000	"			99.975	" 30 "
"	"	"	"			1000	"			100.00	" " "
"	"	Holland	"			1000	"			100.00	" " "
"	"	"	"			4000	"			99.875	" " "
"	"	"	"			3000	"			99.925	" " "
"	Pretoria	Russia	"			325	"	Russian		99.85	" " "
"	"	"	8/25			184	"	"		99.85	" " "
W. H. B. Totten & Co.	Honiton	Germany	8/27			1000	"			99.95	Sept. 1 "
G. A. Jahn & Co.	"	Russia	"			1857	"			99.925	" " "
John Kissock & Co	"	"	"			1866	"			99.95	" " "
"	"	"	"			1856	"			99.925	" " "
Wallace, M. & Co.	"	"	"			696	"			99.975	" " "
"	"	"	"			234	"			99.975	" " "
Henry Christie	"	"	8/28			936	"			99.925	" " "
"	"	"	"			930	"			99.925	" " "
"	"	"	"			936	"			99.925	" " "

IMPORTATIONS OF REFINED SUGAR.

New York.. 189

Importer	Vessel	Where From	Date of Entry	Date of Shipment	Marks	No. of Packages	Character of Product	Color, D. S.	Rate of Duty	Appraised Value	Remarks
Hills Bros & Co.	Honiton	Russia	8/28			580	Ref.			100.00	Sept. 1 1900
"	"	"	"			1857	"			100.00	" " "
"	"	"	"			2221	"			100.00	" " "
"	"	"	"			1293	"			100.00	" " "
"	"	"	"			594	"			99.975	" " "
"	Norge	"	8/27			700	"	Russian		99.925	" 6 "
"	"	"	"			325	"	"		99.875	" " "
"	"	"	"			244	"	"		99.90	" " "
K. M. Kuhns	"	Germany	"			375	"	"		99.95	" " "
"	"	"	"			125	"	"		99.95	" " "
Hills Bros & Co.	Statendam	Amsterdam	8/13			2500	"			99.93	" 8 "
"	"	"	"			5000	"			99.975	" " "
"	"	"	"			2100	"			100.00	" " "
"	"	"	"			400	"			100.00	" " "
Rogers Holloway & Co.	Assyria	Hamburg				2240	"	at Boston		100.00	" 11 "
Stone Downer & Co.	English King	Antwerp				1000	"	" "			" " "
S. S. Pierce & Co.	Bulgaria	Cologne				300	"	" "			" " "
R. Crooks & Co.	Brisgavia	Danzig				468	"	" "			" " "
	Helgoland	Bremen			L. W. C.	928	"	" Baltimore		99.5	" " "
	"	"				931	"	" "		99.5	" " "
	Belgia	Hamburg				684	"	" "		99.5	" " "
	Lord Antrim	Bremen				1868	"	" "		99.5	" " "
	Venango	R'dam				500	"	" "		99.5	" " "

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1009

IMPORTATIONS OF REFINED SUGAR.

New York.....189

Importer.	Vessel.	Where From	Date of Entry.	Date of Shipment.	Marks.	No. of Packages	Character of Product.	Color D. S.	Rate of Duty.	Appraised Value.	Remarks.
Hills Bros. & Co	Maasdam	Holland	9/4			2000	Ref.			99.975	Sept. 14, 1900
"	Amsterdam	"	9/11			3300	"			100.00	" " "
"	"	"	"			2500	"			99.95	" " "
"	Graf. Waldersee	Russia	9/15			276	"			99.95	" 22 "
"	"	"	"			432	"			100.00	" " "
"	"	"	"			117	"			100.00	" " "
"	Statendam	Holland	9/19			2000	"			100.	" 26 "
"	"	"	"			1700	"			100.	" " "
"	"	"	"			500	"			100.	" " "
"	"	"	"			1000	"			100.	" " "
"	"	"	"			1000	"			100.	" " "
Knauth, N. & K.	Pretoria	Germany	9/20			500	"			99.95	" 28 "
G. A. Jahn & Co.	Bulgaria	"	9/25			500	"			99.875	" " "
"	Princes Irene	"	9/21			1261	"			99.90	Oct. 3, "
Wallace M. & Co.	Friesland	Belgium	9/27			1000	"			99.925	" " "
Hills Bros & Co.	Spaarndam	Holland	9/26			2000	"			99.975	" " "
"	"	"	"			500	"			100.	" " "
"	"	"	"			1250	"			100.	" " "
"	"	"	"			1250	"			100.	" " "
	Guernsey	Hamburg	"		M. M.	428	"	at Baltimore		99.5	
	"	"	"		"	902	"	"		99.5	
	"	"			"	1872	"	"		99.5	

IMPORTATIONS OF REFINED SUGAR.

New York, _____ 189

Importer.	Vessel.	Where from	Date of Entry.	Date of Shipment.	Marks.	No. of Packages	Character of Product.	Color D. S.	Rate of Duty.	Appraised Value.	Remarks.
Rogers, Holloway & Co.	Assyrian	Hamburg			Haman Germany M.M.	2240	Ref.	at Phila.		99.90	
J. W. Hampton, Jr., & Co.	"	"			Russia R	810	"	"		99.85	
"	"	"			Russia	928	"	"		99.90	
Rogers, Holloway & Co.	"	"			Hansa	2240	"	at Boston			
R. Crooks & Co.	Grosser Krufurst	Germany	9/26			200	"			99.925	Oct. 4, 1900
"	"	"	"			101	"			99.975	" " "
"	"	"	"			306	"			99.95	" " "
"	"	"	"			102	"			99.95	" " "
"	"	"	"			250	"			99.925	" " "
Hills Bros. & Co.	Rotterdam	R'dam	10/1			1000	"			99.925	" " "
Wallace, Mullen & Co.	Westernland	Belgium	10/11			1000	"			99.925	" 20, "
Hills Bros. & Co.	Cap Fero	Germany	10/15			700	"	Austrian		99.975	" 23, "
"	Lama	Holland	10/19			500	"			99.85	" 24, "
"	"	"	"			500	"	Austrian		99.85	" " "
"	Graf. Waldersee	Germany	10/27			216	"			99.975	Nov. 9, "
"	Patricia	"	10/20			500	"			99.875	" 15, "
"	"	"	"			216	"			99.925	" " "
"	"	Russia	"			584	"			99.925	" " "
"	Rotterdam	R'dam	11/5			550	"	Holland		100.00	" 17 "
"	"	"	"			150	"	"		99.95	" " "
"	"	"	"			100	"	"		99.975	" " "

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718.

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IMPORTATIONS OF REFINED SUGAR.

New York, ——— 189

Importer.	Vessel.	Where From	Date of Entry.	Date of Shipment.	Marks.	No. of Packages.	Character of Product.	Color D. S.	Rate of Duty.	Appraised Value.	Remarks.
Hills Bros. & Co.	Rotterdam	R'dam	11/5			1500	Ref.			99.975	Nov. 20 1900
"	"	"	"			3200	"			99.925	" " "
"	"	"	"			1500	"			99.925	" " "
Park & Tilford	St. Louis	France	11/12			25	"			99.95	" " "
G. A. Jahn & Co.	Belgravia	Russia	11/15			1832	"			99.90	" " "
"	Island	"	11/12			920	"			99.975	" " "
Hills Bros. & Co.	Belgravia	"	11/5			928	"			99.90	" " "
"	"	"	"			973	"			99.90	" " "
"	"	"	"			464	"			99.90	" " "
"	"	"	11/15			856	"			99.925	" 23 "
Wallace, Muller & Co	KrWm der Grosse	"	11/24			880	"			99.75	" 30 "
John Kissack	Norge	"	11/26			1012	"			99.90	Dec. 8 "
Hewlett & Lea	"	"	"			1802	"			99.875	" " "
G. A. Jahn & Co.	"	"	"			854	"			99.95	" " "
"	Cap. Frio	"	11/30			185	"			99.875	" " "
Hills Bros. & Co.	Zillah	Holland	11/23			2500	"			99.90	" " "
"	"	"	"			1000	"			99.975	" " "
Wallace, Muller & Co.	Noordland	Belgium	12/1			1000	"			99.95	" 10 "
Fellows, Sparks & Co	Thordis	Austria	12/6			500	"			99.975	" 13 "
Hills Bros. & Co.	"	Germany	12/5			1500	"	Austrian		100.00	" " "
"	"	"	"			3000	"	"		100.00	" " "
"	"	"	"			3000	"	"		100.00	" " "

IMPORTATIONS OF REFINED SUGAR.

New York,———————189

Importer.	Vessel.	Where From.	Date of Entry.	Date of Shipment.	Marks.	No. of Packages.	Character of Product	Color D. S.	Rate of Duty.	Appraised Value.	Remarks.
Hills Bros. & Co.	Spaamdam	Holland	12/14			650	Ref			100.00	Dec 21. 1900
"	"	"	"			500	"			100.00	" " "
"	"	"	"			2000	"			99.975	" " "
"	"	"	"			500	"			100.00	" " "
"	Zillah	"	11/23			800	"			99.975	" " "
"	"	"	"			2150	"			99.975	" " "
"	"	"	"			500	"			99.975	" " "
"	"	"	"			500	"			99.975	" " "
"	Norge	Russia	11/24			920	"			99.925	" 28 "
G. A. Jahn & Co	"	"	11/26			1000	"			99.925	" " "
Hills Bros. & Co	Thordis	"	12/5			2916	"			100.00	" " "
"	Rotterdam	R'dam	12/19			1250	"			99.95	" 31 "
"	"	"	"			1650	"			99.975	" " "
"	"	"	"			500	"			99.975	" " "
"	"	"	"			600	"			99.975	" " "
Baltimore	Helgoland	Bremen			Mileden	500	"			99.50	No Date
"	"	"			T. T.	400	"			99.50	" "
"	Tampico	R'dam			A. P.	1000	"			99.50	" "
W. N. Proctor & Co	Westphalia	Hamburg				1000	"	Boston			" "
G. A. Jahn & Co	Armenia	"				4000	"	"			" "
W. N. Proctor & Co	Westphalia	"				1000	"	"			" "
S. S. Prince & Co	Sremia	B'deaux				30	Ref French	"			" "

720.

1013

IMPORTATIONS OF REFINED SUGAR.

New York,.....189

Importer	Vessel	Where From	Date of Entry	Date of Shipment	Marks	No of Packages	Character of Product	Color D. S.	Rate of Duty	Appraised Value	Remarks
Parrott & Co.	Algo	Hong Kong				1250					No date
"	Nippon Maria	"				1250					" "
"	Rio de Janiero	"				1250					" "
"	Coptic	"				1250					" "
"	America Man	"				1250					" "
"	c/o Peking	"				1250					" "
South'n Pac. R. R.	Rio de Janiero	"				1000					" "
M.J.Branderstein & Co	"	"				4000					" "
"	Coptic	"				7688					" "
"	c/o Peking	"				4480					" "
Hills Bros & Co.	Amsterdam	Holland	12/16			1100	Ref			99.95	Jany 5 1901
"	"	"	12/26			250	"			99.975	" " "
Wallace M. & Co.	Penna	Germany	12/27			2040	"			99.875	" " "
Arbuckle Bros.	Johan	Russia	1/3			2205	"			99.825	" 15 "
Hoey G. & Co.	Penna	England	1/2			287	"			99.90	" " "
Hills Bros & Co.	Peter Jebsen	Germany	1/4			1500	"	Aust		99.95	" " "
"	"	Russia	"			1856	"			99.975	" " "
"	"	"	"			3895	"			99.975	" " "
"	"	"	"			477	"			99.975	" " "
"	"	"	"			2098	"			99.925	" " "
G. A. Jahn & Co.	"	Germany	"			1890	"			99.975	" " "
Wallace M. & Co.	"	"	1/7			930	"			99.95	" " "

IMPORTATIONS OF REFINED SUGAR.

New York,..... 189

Importer	Vessel	Where From	Date of Entry	Date of Shipment	Marks	No. of Packages	Character of Product	Color D. S.	Rate of Duty	Appraised Value	Remarks
Hewlett & Lee	Peter Jebsen	Germany	1/7			1879	Ref.			99.925	Jany 15, 1901
"	"	"	"			476	"			99.90	" " "
J. Kissock & Co.	"	"	1/5			461	"			99.925	" " "
"	"	"	"			464	"			99.925	" " "
"	"	"	"			1044	"			99.975	" " "
Fellows & Sparks	"	Austria	1/4			500	"			99.925	" " "
Hoey, G. & Co.	Buffalo	Germany	1/10			250	"			100.00	" 16, "
Hills Bros. & Co.	Potsdam	Holland	1/8			3000	"			100.00	" " "
"	Statendam	"	12/31			2000	"			99.975	" " "
Arbuckle Bros.	Johan	Russia	1/3			13875	"			100.00	" " "
G. A. Jahn & Co.	Phœnicia	Germany	1/18			496	"			100.00	" 23, "
New Orleans.											
F. J. Henderson	Asia	Tangerunde				1300				99.9	
Schmidt & Zigler	"	"				250				99.8	

IMPORTATIONS OF REFINED SUGAR.

New York,.....189

Importer	Vessel	Where From	Date of Entry	Date of Shipment	Marks	No. of Packages	Character of Product	Color, D. S.	Rate of Duty	Appraised Value	Remarks
Fellows & Sparks	Afghanstan	Austria	1/15			1000	Ref.			100.00	Jany. 31, 1901
J. Kossock & Co.	Patricia	Germany	1/22			560	"			99.925	" " "
Wallace, M. & Co.	Afghanstan	"	1/16			995	"			100.00	" " "
" "	Patricia	Russia	1/21			1000	"			99.975	" " "
G. A. Jahn & Co.	Weimar	Germany	1/29			602	"			100.00	Feb'y 9, "
Hills Bros & Co.	"	Russia	"			444	"			99.875	" " "
Hewlett & Lee	"	Germany	"			1693	"			99.975	" " "
Rosenstein Bros.	Pocahontas	Austria	1/31			100	"			99.95	" " "
Hoey, G. & Co.	Consuelo	Germany	2/5			250	"			99.975	" " "
Hills Bros. & Co.	Potsdam	Holland	2/15			2800	"			100.00	" 19, "
Baltimore	Wurzburg	Bremen			M.I.O.T.	926	"			99.5	
"	"	"			M.I.O.S.	230	"			99.5	
"	Belgravia	Hamburg			E R.	1000	"			99.5	
"	Wurzburg	Bremen			W. M..	921	"			99.5	
"	Durango	Holland			Russia J. H.	1500	"			99.5	
"	Wurzburg	Bremen			F. C. I.	500	"			99.5	
"	"	"			F. K.	1000	"			99.5	
"	Bengalia	Hamburg			B. K.	1000	"			99.5	
"	"	"			J. S.	450	"			99.5	
H. O. Wilbur & Son	"	"			B. K.	2600	"			99.5	
Philadelphia	Gurnsey	"	1/9.			100	"			98.675	
"	"	"	"			10	"			95.3	
J. W. Hampton & Co.	"	"			W.M.Co	937	"			99.85	

723 EXHIBIT 7 FOR IMPORTERS.

Suit No. 2918, Bartram Bros. *vs.* U. S. and two other suits.

The Sugar Beet, Phila., Aug., 1900.

Third meeting of the International Commission for Uniform Methods of Sugar Analysis.

This meeting was held in Paris, July 24th. Our editor being present, gleaned the following notes from the monograph of our friend Dr. H. Wiley. The title was "Correction of polariscopic readings for changes in temperature." Two years ago at the meeting of the Congress of Applied Chemistry, in Vienna, a paper was read by Dr. Wiley on the influence of temperature on the polarization of sugar in an instrument with quartz wedge compensation. Since then the results have been verified by many distinguished chemists of Europe and America. Two other papers on the same subject have appeared during the past few months. One of these give- the results of an investigation on the influence of temperature on specific rotation, and shows that for each degree of change the number expressing the change in the specific rotation for pure sugar is 0.0144. "This is a somewhat larger factor than the one given by Dr. Wiley in his paper. It must be remembered that his determinations were made with a compensating polariscope, and with white light. The total variation in rotation was determined, and that part of it due to change in specific rotation was found by calculating the magnitude of all the other variants, and subtracting this from the total variation observed. It is evident that the number obtained by me for the magnitude of the variation due to change in specific rotation contains not only all the errors of observation but also any errors which may have arisen by ascribing wrong values to any of the other variants. * * * Polariscopes having quartz wedge compensations are almost universally used on the continent of Europe, with the exception of France; in England, in the United States, and in the sugar-producing portions of the tropics. They are also used to some extent in France, and by reason of the use of white light, are more convenient for commercial purposes than instruments with monochromatic light. These instruments are almost universally graduated for a temperature of 17.°5 and employ a normal weight of sugar °26.048 grams weighed in air, with brass weights. This quantity of sugar is dissolved in water and the volume of the solution completed to 100.23 c. c., which is the capacity of a flask holding 100 grams of water at a temperature of 17.°5. The reading of such a solution in a tube two decimeters in length, at a temperature of 17.°5, is 100, and a scale thus marked and divided from 0 to 100 is called the Vantzke
724 scale * * * for each degree of variation from the normal 17.°5, a correction of 0.03 must be applied to the observed reading. If the temperature be above 17.°5, this correc-

tion must be added—if below that degree, subtracted. For instance, a pure sugar solution when polarized at 17.°5 gives a reading of 100.00. If now the temperature sinks to 4° and the polariscope, sugar, tubes, flasks and water are all at the same temperature—the same sugar will give a reading of 100.43. On the other hand, if the temperature rises to 40°, the reading will be 99.28. The extremes of temperature at which my investigations were made were 4° and 40° and the data above mentioned were thus obtained.

"The following rule is of general application in the use of all quartz wedge compensation instruments:

"The reading of the instrument and the temperature of observation having been determined, multiply the difference between the observed temperature and 17.°5 by 0.03 and add the product to the observed reading if the temperature be above 17.°5 and subtract if below 17.°5" * * *

"If the Laurent instrument, which is widely used in France, be employed, the magnitude of the correction is less. In this instrument there is no quartz compensation, and the variation in the observed rotation due to temperature changes is almost solely due to change in specific rotation. In these instruments a true cubic centimeter flask is employed for preparing the solutions, and the rotation produced is compensated by turning the analyzing nicol on its optical axis until the neutrality of the field of vision is restored. If we place the magnitude of the rotation due to each degree of temperature at .0144 for pure sugar, the variation will be 66.5+.0144 for each degree from the temperature at which the instrument is graduated. If this be reduced to a scale of 100, this would amount to 0.0215 for each degree. I believe the Laurent instrument is graduated at 15°. The rule for correction for the Laurent type of polariscope is therefore as follows:

"Find the difference between the observed temperature and 15 and multiply this difference by .0215. Add the product to the observed reading when the observed temperature is above 15°, and subtract when below."

725 EXHIBIT 7—A. FOR GOV'T.

Suit No. 2198.

Bartram Bros. *vs.* U. S. and two other suits.

The Sugar Beet, August, 1900.

Third meeting of the International Commission for Uniform Methods of Sugar Analysis.

This meeting was held in Paris, July 24th. Our editor being present, gleaned the following notes from the monograph of our friend Dr. H. Wiley. The title was "Correction of polariscopic readings for changes in temperature." Two years ago at the meeting of the

Congress of Applied Chemistry, in Vienna, a paper was read by Dr. Wiley on the influence of temperature on the polarization of sugar in an instrument with quartz wedge compensation. Since then, the results have been verified by many distinguished chemists of Europe and America. Two other papers on the same subject have appeared during the past few months. One of these gives the results of an investigation on the influence of temperature on specific rotation, and shows that for each degree of change the number expressing the change in the specific rotation for pure sugar is 0.0144. "This is a somewhat larger factor than the one given by Dr. Wiley in his paper. It must be remembered that his determinations were made with a compensating polariscope, and with white light. The total variation in rotation was determined, and that part of it due to change in specific rotation was found by calculating the magnitude of all the other variants, and subtracting this from the total variation observed. It is evident that the number obtained by me for the magnitude of the variation due to change in specific rotation contains not only all the errors of observation but also any errors which may have arisen by ascribing wrong values to any of the other variants. * * * Polariscopes having quartz wedge compensations are almost universally used on the continent of Europe, with the exception of France; in England, in the United States and in the sugar producing portions of the tropics. They are also used to some extent in France, and by reason of the use of white light are more convenient for commercial purposes than instruments with monochromatic light. These instruments are almost universally graduated for a temperature of 17.°5 and employ a normal weight of sugar °26.048 grams weighed in air, with brass weights. This quantity of sugar is dissolved in water and the volume of the solution completed to 100.23 c. c., which is the capacity of a flask holding 100 grams of water at a temperature of 17.°5. The reading of such a solution in a tube two decimeters in length, at a temperature of 17.°5, is 100, and a scale thus marked and divided from 0 to 100 is called Ventzke scale * * * for each degree of variation from the normal 17.°5, a correction of 0.03 must be applied to the observed reading. If the temperature be above 17.°5, this correction must be added—if below that degree, subtracted. For instance, a pure sugar solution when polarized at 17.°5 gives a reading of 100.00. If now the temperature sinks to 4° and the polariscope, sugar, tubes, flasks and water are all at the same temperature—the same sugar will give a reading of 100.43. On the other hand, if the temperature rises to 40°, the reading will be 99.28. The extremes of temperature at which my investigations were made were 4° and 40° and the data above mentioned were thus obtained.

726

"The following rule is of general application in the use of all quartz wedge compensating instruments:

"The reading of the instrument and the temperature of observation having been determined, multiply the difference between the observed temperature and 17.°5 by 0.03 and add the product to the

observed reading if the temperature be above 17.°5 and subtract if below 17.°5" * * *

"If the Laurent instrument, which is widely used in France be employed, the magnitude of the correction is less. In this instrument there is no quartz compensation, and the variation in the observed rotation due to temperature changes is almost solely due to change in specific rotation. In these instruments a true cubic centimeter flask is employed for preparing the solution, and the rotation produced is compensated by turning the analyzing nicol on its optical axis until the neutrality of the field of vision is restored. If we place the magnitude of the rotation due to each degree of temperature at .0144 for pure sugar the variation will be 66.5 + .0144 for each degree from the temperature at which the instrument is graduated. If this be reduced to a scale of 100, this would amount to 0.0215 for each degree. I believe the Laurent instrument is graduated at 15°. The rule for correction for the Laurent type of polariscope is therefore as follows:

"Find the difference between the observed temperature and 15 and multiply this difference by .0215. Add the product to the observed reading when the observed temperature is above 15°, and subtract when below."

The committee, after hearing a full discussion of the question decided that hereafter the influence of temperature on the polarization of sugar should be taken into consideration. In order to fix a general principle which would be universally applicable, it was voted: "That the standard temperature of polarization be fixed at 20.°6, and that polariscopes be graduated at that temperature. In all cases, the instrument, the other apparatus and the sugar solutions should be at the temperature normal. In countries where
727 uniformly higher temperatures exist, it was recommended that the polariscopes be graduated at 25°, 30°, or other suitable degrees. As a standard for graduation, chemically pure sugar was recommended. It was also recommended that in each country a single institution should be established for preparing the pure sugar and directing the standardization. This institution is to be requested to send samples of the chemically pure sugar to those desiring them. Where it is not convenient to send samples of sugar, the central scientific institution above mentioned is requested to standardize quartz plates with the pure sugar and send the plates to the localities where they are desired for standardizing polariscopes and controlling polarization.

The commission, with one exception, are of the opinion that the specific rotatory power of sugar is profoundly affected by temperature falling as the temperature rises and *vice versa*.

The commission also recommended some general rules to be followed in the polarization of sugar, but took no definite action in regard to the adoption of an international normal weight of sugar, which, with a volume of 100 c. c., and at a temperature of 20°, should give a reading of 100 divisions of the scale—*i. e.*, be pure sugar. In all cases it was recommended that the solution of sugar be made up to the mark on the flask at the same temperature at which it is to be polarized.

EXHIBIT 9 FOR IMPORTERS.

Suit 2918, Bartram Bros. *vs.* U. S. and two other suits.

En ségle générale lotes les analyses de sucre douvenéttre foites à 20° C. et la verification du polarimêtre doit ce foire à 20 C (mois dons les poys on l'ècortement de la temperature de 20° C. est connent tres grand il fout gradner les polarimétré four les temperature ordinàre on fairé une correctionin convenable oux lectures du polarimetre le est à deré, &c.

Je propose à introduce la phrase entre parenthesis. W. G.

EXHIBIT 10 FOR IMPORTERS.

Suit No. 2918.

(Exhibit 10 is found on pages 761-2 in the testimony of John A. Sherer.)

728 EXHIBIT 11 FOR IMPORTERS.

Suit No. 2918, Bartram Bros. *v.* U. S., & others.

Influence of Temperature upon the Estimation of Sugar.

Reply.

By Dr. F. G. Wiechmann.

In reference to the observations of Dr. Otto Schonrock "On the question of the influence of temperature upon specific rotation of sugar" (this journal, technical part, vol. 51, 1901, page 106) I would like briefly to make the following reply:

In opposition to the opinion of Dr. Schonrock I do not yet believe that the optical influence of the cover glasses in Mr. Schonrock's experiments should be left out of consideration, even if the expansion of the liquid inclosed between them should have exerted no pressure upon them. That the luted cover glasses, even in an empty tube, were optically active, Dr. Schonrock himself shows (this journal, technical part, vol. 50, 1900, page 422). But now these glasses were luted upon the brass vessels (*ibid.*, p. 421).

That the expansion during warming in the case of glass and of brass is different is well known; that now in consequence of this fact, with cover glasses thus luted, further tension phenomena must have occurred by warming, is indeed a just conclusion.

I am sorry not to have at hand the paper mentioned by Dr. Schonrock (Zeitchrift für Instrumentenkunde, vol. 18, 1898, page 187). Consequently I am not able to have a correct understanding of his observations relating to "the fine dust present in the sugar solution," or "a dust-free sugar solution."

If this "dust" were a foreign substance and not sugar the research in question could not be considered as a study of the deportment of a pure sugar solution. Should this "dust" on the contrary have shown itself to be a separated pure sugar this will have meant a marked change in the concentration of the observed solution and would have rendered excessively difficult, if not made entirely impossible, the correct interpretation of any observed polarization changes through change of temperature. Going into my own experimental researches Dr. Schonrock writes "his observations must moreover have been burdened with systematic errors." But what is the foundation of this criticism? The sources of error mentioned by Dr. Schonrock, the evaporation of water from the sugar solution "with rising temperature" cannot be cited as an explanation since by keeping the temperature of the experiment room constant for hours, before and during the observations, this danger was specially avoided.

729 Further Dr. Schonrock mentions that the methods of work which I employed were of a character "whose incidental errors are markedly greater than mine (Schonrock's)."

To this I make answer that it is exactly these methods and only these methods of which practice makes use in order to measure polarization values of sugars for the sugar trade and for the determination of impert duty.

Just because the use of these methods belong- to the actual conditions of technical sugar analysis I chose them in order therewith to determine any dependence of the specific rotation of saccharose on temperature.

It was the most careful use of these methods which led me to the conclusion: "Under the actual conditions of technical sugar analysis the specific rotation of saccharose is constant."

I have solely paid attention to [to do with] the conditions of practice and in this respect Schonrock's work absolutely does not contradict either my work or my results.

Exhibit 12a for Importers.

No. 2918, Bartram Bros. *v.* U. S., etc.

Nov. 17, 1900.

"I had read the article in the "Sugar Beet" some time ago. (Upon request of the publisher we exchange with that journal.) On account of the insignificance of the journal I have attached no importance to the same, but have now sent the original protocol to the editor with the request to print it, as his report of August is not exact in several points.

I believe it is best to ignore such utterings entirely, in scientific questions it is not the little (illegible) who decide, but the experiment, and we both will not rest until we have made the matter clear. That the cut in the 'Sugar Beet' is meant for you, is indeed evident, but it is just as evident that the author is wrong.

As chairman of the committee I myself after the debate, Wiley-Wiechmann-Brodhuhn, took occasion to declare that the committee could not decide scientific questions of dispute, nor could it vote as to who was right. As far as I am personally concerned, I consider the question not cleared. The majority of the members of the committee has *not* expressed any opinion regarding the influence of temperature on the specific rotation of sugar, hence the remark of the 'single exception' can impossibly refer to the commission at all.

Just because the commission took my point of view *Wiley's proposition could not be accepted*, and in the place of the same the resolution of Sachs was placed. Moreover this was not an 'onprise' because we had amongst ourselves agreed to this in prior discussion.

In your place I would ignore such (illegible comments?).

* * * * * * *

730 That one will ever succeed in discovering correction factors which shall be valid for all cases, as Wiley proposes, I regard as improbable. Nor can this be deduced from Schoenrock's numbers as these have been obtained under other conditions than we could ever observe in practice, if only on account of filetration."

EXHIBIT 12B FOR IMPORTERS.

No. 2918, Bartram Bros. *v.* U. S. & Others.

FEB'Y 7, 1900.

Letter addressed to the American Sugar Refining Company.

"Finally I beg you to consent that Mr. Weichmann may, in the committee, undertake the report on the influence of temperature on polarization."

EXHIBIT 12C FOR IMPORTERS.

No. 2918, Bartram Bros. *v.* U. S. & Others.

DEC. 12, 1898.

"That my investigations thus far concerning the influence of temperature do *not* confirm Wiley's statements, I have already written you. It is however possible, and Brodhuhn is also of this opinion, that saccharimeters exist, for which Wiley's observations may hold good."

EXHIBIT 12D FOR IMPORTERS.

No. 2918, Bartram Bros. *v.* U. S. and Others.

DEC. 1, 1898.

"The apparatus (saccharimeters) which I have until now examined at +20 +30 and +40 C., show for the quartz-plate at all temperatures the same polarization. Hence Wiley is either mistaken

or I have not had such faulty instruments in my hands. Brodhuhn also is of the opinion, if the phenomenon occurs, that only stress ("Pressung") of the wedges is at fault."

731 EXHIBIT 12E FOR IMPORTERS.

Suit No. 2918, Bartram Bros. *v.* U. S. & Others

BERLIN, *September* 19, 1898.

Journ. No. 499.

Mr. F. G. Wiechmann, New York.

MY DEAR MR. WIECHMANN: "To my regret the second of the three communications which you have lately addressed to me, has been lost. It has probably slipped into some document, with which it has been laid aside."

"I regret that I cannot now exactly recall which questions you addressed to me in the same, in the name of your company. I only recall the question "whether the directions of the regulations for sugar-examinations of July 24th, 1894, in consequence of their non-lucid and in part erroneous form could result in having the polarizations of imported sugar by chemists turn out too high."

According to my opinion this will indeed be the case.

In following the directions the chemists will in adjusting their saccharimeters find the adjustment of the instrument too low, as they indeed make up (*i. e.* the solution F. G. W.) at 17.5° C. but observe at a higher temperature and will, in consequence, ascribe the polarization 100 to a more dilute pure sugar solution than one which contains the normal weight in 100 C. C.

In actual working the chemist will however in filling up to the mark, hardly proceed in the same manner in respect to the temperature, but will pay no special regard to the same. The result of this will be, that they, which is indeed, quite correct, will have to deal with approximately equal temperatures in filling to the mark as well as in observing in the polariscope. In consequence they will find the correct polarization. But as the instrument is set too low, the polarizations which they read off will turn out too high by about 3/10 to 4/10% if the work be done at 30° C., under circumstances even more."

In regard to your third letter, of the 30th of last month, I will, self evidently, not publish my views concerning the regulations. The high polarizations of the German commercial chemists have again become a subject of complaint, on the part of our refiners, especially in the proceedings of our branch societies, which you will find published in our society journal. A definite proof of this assertion however, is not to be found in the literature, since naturally, the refineries have always contended for the accuracy of the high polarizations and the raw sugar factories for the accuracy of the low polarizations, and an arbitration analysis does not exist.

I have myself on only one occasion publicly touched upon the subject, in a meeting of our commercial chemists in Berlin,
732 the minutes of which you will find in the January number of our society journal for 1898. The comment referred to is recorded on page 18, in the third paragraph.

With cordial regards,

Yours most sincerely,

(Signed) A. HERZFELD.

733 In the Circuit Court of the United States for the Southern District of New York.

In the Matter of the Application of THE AMERICAN SUGAR REFINING COMPANY OF NEW YORK for a Review of the Decisions of the Board of General Appraisers as to the Rate and Amount of Duty on Certain Merchandise Imported by said Company, per "Myrtledene" and Other Vessels.

Deposition taken in the above entitled proceeding before Albert S. Wright, notary public, April 28th, 1905, pursuant to the adjoined notice, the hearing having been duly adjourned, without prejudice, to this time and place.

Appearances.

The witness, Alexander Herzfeld.

Mr. H. B. Closson, of Counsel for the American Sugar Refining Company.

Mr. Charles D. Baker, Assistant United States Attorney, specially appears for the sole and only purpose of objecting to any evidence being produced at this hearing on depositions *de bene esse* on the ground,

First. That such proceeding is irregular and null;

Second. That no authority is given by the Revised Statutes or by any statutes to take the deposition of witnesses *de bene esse*, and that the only form in which evidence can be taken in this matter is that provided by the Act known as the "Customs Administrative Act of the United States and acts amendatory thereof and supplemental thereto; and

734 Third. That the United States Circuit Court has no power nor jurisdiction to hear and entertain evidence produced by depositions *de bene esse* as above stated.

It is hereby stipulated that the deposition is to be taken subject to all objections to be taken at the trial except as to the form of the questions.

The filing of the deposition is waived; a copy to be furnished to the United States Attorney.

ALEXANDER HERZFELD, being first duly sworn, testified as follows:

Direct examination by Mr. CLOSSON:

Q. Where do you live?
A. I live in Berlin, Germany.
Q. How long have you been in the United States?
A. About a week.
Q. Are you about to return to Berlin?
A. Yes.
Q. When?
A. 9th of May.
Q. What is your profession?
A. I am teacher in the Technical High School in Charlottenburg, Professor in Ordinary of the Agricultural High School in Berlin, and Director of the Institute of Sugar Industry which belongs to the Agricultural High School.
Q. Are those institutions which you have mentioned supported by the German Government?
A. Yes; they are the property of the German Government.
Q. What is the Institute of Sugar Industry which you have mentioned?
735 A. It is an institution which has been erected by the German government for the sole purpose of studying questions concerning the sugar industry, but which is also supported by the German Sugar Manufacturers.
Q. State what your education as a sugar chemist has been and what positions you have held in that respect.
A. I have pursued the ordinary career of a University Professor. First I have taken my doctor's degree; then I have been assistant in scientific institutions of universities for five years. I have also for some time been in practice in factories, and now for twenty-two years I have been actually occupied, first in the laboratories of the Institute for Sugar Industry, and since 1887 I have been director of that Institute. I have been steadily occupied in studying the questions of sugar analysis.
Q. You are the President of the International Commission for uniform methods of sugar analysis?
A. Yes; since 1896, I believe.
Q. And you presided at the meeting of that Commission in July 1900, at Paris?
A. Yes.
Q. Have you for many years specially devoted yourself to the sugar analysis by the polariscope?
A. I have, yes.
Q. What opinion have your researches in the use of the polariscope in testing sugar, if any, led you to form in regard to the influence of temperature upon the rotary power of sugars, sucrose?
A. I have found in effect that there is no influence of temperature, or if there is one it can practically only be in the direction of raising the polarization. If the temperature is higher than that at which the apparatus has been graduated it may become too high

because the solution of sugar which is prepared for analysis loses water during the filtration by evaporation. It therefore becomes too concentrated and the degrees shown by the polarization apparatus, therefore, will be too high.

736 In the Circuit Court of the United States for the Southern District of New York.

No. 3825.

In the Matter of the Application of THE AMERICAN SUGAR REFINING COMPANY OF NEW YORK for a Review of the Decisions of the Board of General Appraisers as to the Rate and Amount of Duty on Certain Merchandise Imported by said Company, per "Myrtledene" and Other Vessels.

UNITED STATES OF AMERICA,
Southern District of New York, State of New York, County of New York, ss:

Alexander Herzfeld, residing in the City of Berlin, Germany, being by me first duly sworn, did on the 28th day of April, 1905, at the office of Messrs. Parsons, Closson & McIlvaine, at No. 52 William Street in the Borough of Manhattan, City, County and State of New York, make the following deposition before me, the undersigned, Albert S. Wright, a duly commissioned and sworn Notary Public of the State of New York, in and for the County of New York on behalf of the petitioner in a certain proceeding now pending in the Circuit Court of the United States, for the Southern District of New York, wherein the American Sugar Refining Company of New York is the petitioner for a review by the said Court of the decisions of the Board of General Appraisers as to the rate and amount of duty on certain merchandise imported by said Company per "Myrtledene" and other vessels:

737 Q. You refer, do you, to the evaporation which necessarily takes place during the progress of the preparation of the solution in setting it in the polariscopic tube?

A. Yes.

Q. Have you made any special study or obtained any special information as to the amount of loss by evaporation during the course of the preparation of the solution and the extent of the effect that may have in raising the reading over what would otherwise be obtained?

A. I have made a study and also Prof. Landolt, a sugar expert, who is the oldest sugar expert and who has also written a very renowned book on sugar analysis, has told me often that he found that the error which arises from the evaporation of the sugar solution often amounts to .3 degrees Ventzke. I have found the same.

Q. Your experiments in polarizing sugar led you to form the

opinion that the plus error caused by evaporation may amount to .3 degrees Ventzke?

A. Yes.

Examination adjourned by consent, without prejudice, to Tuesday morning, May 2nd, at 10 A. M.

Cross-examination waived.

PROF. DR. HERZFELD.

I, the above-named Albert S. Wright, do hereby certify, that pursuant to the annexed notice, dated April 24th, 1905, issued and served in the above mentioned proceeding, wherein the said American Sugar Refining Company of New York is the petitioner for a review by the said Court of the decision of the Board of General Appraisers as to the rate and amount of duty on certain merchandise imported by said Company per "Myrtledene" and other vessels, and pursuant to due adjournment of the examination specified on the said notice, I was attended on such adjourned day and at the place specified in said notice by Henry B. Closson, Esq., of counsel
738 for the petitioner, and Charles D. Baker, Esq., Assistant United States Attorney, appearing specially for the purpose of making certain objections; that the aforenamed witness Alexander Herzfeld, who was of sound mind and full age, was at such time and place before me carefully examined after first being by me duly sworn and cautioned to testify the truth, the whole truth and nothing but the truth, and he thereupon testified as is above shown; that the deposition by him subscribed as above set forth was reduced to typewriting by a person under my personal supervision and in my presence and by no other person, and was subscribed by the said witness in my presence, and that all was so done, written and signed in the presence of said counsel for the petitioner.

I further certify that the reason for taking said deposition was and is, and the fact was and is, as stated in said notice, that the said Alexander Herzfeld lives in the City of Berlin, Germany, which is more than one hundred miles from the said Southern District of New York, the place where the said suit is appointed by law to be tried, and that he is about to depart from the said Southern District of New York and return to the said City of Berlin, Germany, before the time of the trial of this action; that I am neither of counsel nor attorney to either or any of the parties to said action, nor interested in the event thereof; that the filing of said deposition has been waived.

As witness my hand and seal this 2nd day of May, Nineteen hundred and five.

ALBERT S. WRIGHT,

[SEAL.] *Notary Public of the State of New York, in and for the County of New York.*

739 In the Circuit Court of the United States for the Southern District of New York.

No. 3825.

In the Matter of the Application of THE AMERICAN SUGAR REFINING COMPANY OF NEW YORK for a Review of the Decisions of the Board of General Appraisers as to the Rate and Amount of Duty on Certain Merchandise Imported by said Company, per "Myrtledene" and Other Vessels.

Please take notice that the American Sugar Refining Company of New York, the petitioner herein, will take the testimony of A. Herzfeld, who lives at a greater distance than one hundred miles from the place of trial herein, and who is bound on a voyage to sea, and is about to go out of the United States and out of the District in which this case is to be tried, and to a greater distance than one hundred miles from the place of trial before the time of trial, for use on behalf of the said petitioner, before Albert S. Wright, Esq., a Notary Public of the County and State of New York, in the said District and Circuit, who is not of counsel or attorney to either of the parties hereto, nor interested in the event of this cause, at the office of Parsons, Closson & McIlvaine, the attorneys for the said petitioner, No. 52 William Street, in the Borough of Manhattan, The City of New York, on the 26th day of April, 1905, at two o'clock in the afternoon, and thereafter from day to day as the taking of the deposition may be adjourned; and such testimony will be so taken in accordance with the provisions of Sections 863, 864 and 865 of the Revised Statutes of the United States and the Equity Rules.

Dated New York, April 24, 1905.

PARSONS, CLOSSON & McILVAINE,
Attorneys for the American Sugar Refining Company of New York, Office and Post Office Address, No. 52 William St., Borough of Manhattan, the City of New York.

740 To Henry L. Burnett, Esq., Attorney for United States, for the Southern District of New York.

The taking of the above deposition is hereby adjourned to the 28th day of April, 1905 at 9:30 o'clock in the forenoon at the same place.

Dated April 26, 1905.

(Endorsed:) 3825—U. S. Circuit Court, Southern District of New York.—In the Matter of the Application of The American Sugar Refining Company of New York, for a review of the decisions of the Board of General Appraisers, etc.—Deposition of Alexander Herzfeld.—U. S. Circuit Court, Southern District of New York, Filed Oct. 9, 1905, John A. Shields, Clerk.

741 At a Stated Term of the Circuit Court of the United States of America for the Southern District of New York, held at the United States Circuit Court Rooms in the Post Office Building in the City of New York, on the 28th day of December, in the year of our Lord one thousand nine hundred and five.

Present: The Hon. James P. Platt, Judge.

"A" Suit No. 3825.

THE AMERICAN SUGAR REFINING COMPANY OF NEW YORK
vs.
THE UNITED STATES.

The above cause coming on for hearing and determination before this Court on the application of The American Sugar Refining Company of N. Y., importers, for a review of the questions of law and fact involved in the decisions of the Board of U. S. General Appraisers herein, and on the return of the Board of General Appraisers of the record and evidence taken by them, with their certified statement of the facts involved therein, together with their decisions thereon.

Now after hearing Charles D. Baker, Assistant U. S. Attorney on behalf of the Collector for affirmance, and the said importers, for reversal, on motion of Henry L. Burnett, U. S. Attorney.

It is ordered, adjudged, and decreed that there was no error in said proceedings before said Board of General Appraisers, and that their decisions herein be and the same are hereby in all things affirmed.

JAMES P. PLATT,
U. S. Judge.

Approved as to form.
PARSONS, CLOSSON & McILVAINE,
Attorneys for Importers.

742 (Endorsed:) "A" Suit No. 3825—U. S. Circuit Court, Southern District of New York.—The American Sugar Refining Co. of N. Y. *vs.* The United States.—Judgment of Affirmance.—Henry L. Burnett, U. S. Attorney.—U. S. Circuit Court, Southern District New York, Filed Dec. 30, 1905, John A. Shields, Clerk.

743 United States Circuit Court for the Southern District of New York.

"A" Suit No. 3825.

THE AMERICAN SUGAR REFINING COMPANY OF NEW YORK
against
THE UNITED STATES.

The above named American Sugar Refining Company of New York, feeling aggrieved by the judgment and decree made and entered on the 28th day of December, 1905, in the above entitled cause, does hereby appeal from the said judgment and decree to the Supreme Court of the United States for the reasons specified in its assignment of errors which is filed herewith, and prays that this appeal may be allowed and that a transcript of the record, proceedings and papers upon which said judgment was made, duly authenticated, may be sent according to law to the Supreme Court of the United States.

Dated this 14th day of March, 1906.

PARSONS, CLOSSON & McILVAINE,
Attorneys for Appellant, American Sugar Refining Company of New York, 52 William Street, Borough of Manhattan, City of New York, N. Y.

The following application is granted and the appeal is allowed.
Dated New York, March 29, 1906.

E. H. LACOMBE,
Circuit Judge.

744 (Endorsed:) "A" 3825—U. S. Circuit Court, Southern District of New York.—The American Sugar Refining Company of New York, against The United States of America.—Application for and allowance of appeal.—Parsons, Closson & McIlvaine, Attorneys for Appellant, 52 William Street, N. Y. City.—A copy of the within paper has been this day received at this office. Mar. 30, 1906, Henry L. Stimson, U. S. Attorney.—U. S. Circuit Court, Southern District New York, Filed Mar. 30, 1906, John A. Shields, Clerk.

745 United States Circuit Court for the Southern District of New York.

"A" Suit No. 3825.

THE AMERICAN SUGAR REFINING COMPANY OF NEW YORK
against
THE UNITED STATES OF AMERICA.

Now comes before the Judges of the Supreme Court of the United States the American Sugar Refining Company of New York, appellant, by Parsons, Closson & McIlvaine, its attorneys, and says for

its assignment of errors that the Circuit Court of the United States for the Southern District of New York erred in its proceedings in this cause as follows; that is to say:

1. The Circuit Court erred in affirming the decision of the Board of General Appraisers herein.

2. The Circuit Court erred in not reversing the decision of the said Board of General Appraisers herein.

3. The Circuit Court erred in not holding that the addition to the number of degrees shown by the polariscopic test of said sugars of a certain percentage as a so-called correction for temperature, was and is in addition to the polariscopic test prescribed by the Act of Congress, known as the Tariff Act of July 24, 1897; and in not holding that such addition was and is, therefore, the imposition of an additional tax on said sugars by the Secretary of the Treasury in violation of the provisions of the statutes and Constitution of the United States.

746 4. The Circuit Court erred in not holding that the Act of Congress by the phrase "testing by the polariscope" and "polariscopic test" intended that the words should have the same meaning which had been attributed both by the trade and by the Treasury Department to the same words when used in the previous Tariff Act of March 3rd, 1883.

5. The Circuit Court erred in not holding that the Act of Congress in question by the phrase "testing by the polariscope" and "polariscopic test" intended the same polariscopic test which was then actually in force under the then existing regulations of the Treasury Department with reference to the ascertainment of duties upon imported sugars, and which had been in force under the regulations of the Treasury Department promulgated under the said prior Act of March 3rd, 1883, under date of May 22nd, 1883, in which prior act the same languages had been employed, and which was the only polariscopic test which was then or had ever been in use by the Treasury Department in classifying or determining the rate and amount of duties upon imported sugars; and which was and is the only polariscopic test known to the trade.

6. The Circuit Court erred in holding that any increase of temperature occurring in actual practice reduces the rota-ry power of sugar solution in the polariscope; or otherwise produces a lower test than that which would be obtained at any lower temperature occurring in actual practice.

7. The Circuit Court erred in holding that the assertion of some experts and the denial by others of the existence of any alleged influence of temperature upon the rota-ry power of sugar justifies the Secretary of the Treasury in requiring additions to be made

747 to the observed polariscopic test of imported sugars prescribed by law; and so increasing the rate of duty payable upon them above that prescribed by law.

8. The Circuit Court erred in holding that the polariscopic test means "the percentage of pure sucrose contained in sugar as ascertained by polarimetric estimation."

9. The Circuit Court erred in holding that under the existing

regulations of the Treasury Department "the percentage of pure sucrose contained in sugar" is ascertained; either absolutely, or more approximately than by the polariscopic test itself.

10. The Circuit Court erred in holding that under the existing regulations of the Treasury Department, "the percentage of pure sucrose contained in sugar" or anything else, is "ascertained by polarimetric estimation;" and in not holding that under such regulations whatever is ascertained is ascertained only in part by polarimetric estimation and in part by an arithmetrical process of an addition to the tests shown by the polariscope of a self-styled "correction."

11. The Circuit Court erred in holding that the regulations promulgated by the Secretary of the Treasury under date of October 27th, 1897, or the revised regulations promulgated by him under date of February 17th, 1899, in conformity with which such sugars were tested, are reasonable regulations or are authorized by the laws or Constitution of the United States, in so far as they require additions to be made to the observed polariscopic test of sugar or prescribe a polariscopic test different in any way from that
748 heretofore and then and now in use by the trade and prescribed both by the Treasury regulations of May 13th, 1895, which regulations were in force at the time of the passage of the Tariff Act in question, and the Treasury regulations promulgated by the Treasury department under date of May 22nd, 1883, under the Tariff Act of March 3rd, 1883.

Dated New York, March 14, 1906.

PARSONS, CLOSSON & McILVAINE,
Attorneys for Appellant, American Sugar Refining Company of New York, 52 William Street, Borough of Manhattan, the City of New York, N. Y.

(Endorsed:) "A" 3825—U. S. Circuit Court, Southern District of New York.—The American Sugar Refining Company of New York, against The United States of America.—Assignment of errors.—Parsons, Closson & McIlvaine, Attorneys for Appellant, 52 William Street, N. Y. City.—U. S. Circuit Court, Southern District New York, Filed Mar. 29, 1906, John A. Shields, Clerk.

749 United States Circuit Court for the Southern District of New York.

"A" Suit No. 3825.

THE AMERICAN SUGAR REFINING COMPANY OF NEW YORK
against
THE UNITED STATES OF AMERICA.

Know all men by these presents, That we, the American Sugar Refining Company of New York, as principal, and John A. Sherer, of the City of New York, as surety, are held and firmly bound unto the United States of America, in the sum of Two hundred dollars

($200), to be paid to the said United States of America; For the payment of which, well and truly to be made, we bind ourselves, our heirs, executors, administrators and assigns, jointly and severally by these presents.

Sealed with our seals, and dated this 14th day of March, 1906.

Whereas the above named American Sugar Refining Company of New York, has appealed, or is about to appeal, to the Supreme Court of the United States for a reversal of the judgment or decree made and entered in the above entitled cause by the United States Circuit Court for the Southern District of New York, and a citation has been issued, directing the said United States of America, citing and admonishing it to be and appear at a session of the said Supreme Court of the United States, to be holden at the City of Washington, to show cause, if any there be, why the said judgment or decree should not be reversed, modified or corrected, and speedy justice
750 should not be done in that behalf.

Now therefore, the condition of this obligation is such that if the above named American Sugar Refining Company of New York shall prosecute said appeal to effect and pay all damages and costs if it shall fail to make said appeal good, then this obligation shall be void, otherwise the same shall be and remain in full force and virtue.

In witness whereof, the said American Sugar Refining Company of New York has hereunto caused its seal to be affixed and these presents to be signed by its President, and the said John A. Sherer has hereunto set his hand and seal, this 14th day of March, 1906.

JOHN A. SHERER. [SEAL.]

Sealed and delivered in the presence of:
ALBERT S. WRIGHT,
As to John A. Sherer.

THE AMERICAN SUGAR REFINING COMPANY OF NEW YORK,
ARTHUR DONNER, *President.*

Attest:
C. R. HEIDE, *Sec'y.*

751 UNITED STATES OF AMERICA,
Southern District of New York, County of New York, ss:

On this 14th day of March, 1906, before me personally came Arthur Donner, to me known, who, being by me duly sworn, did depose and say, that he resided in Rye, N. Y., that he is the President of the American Sugar Refining Company of New York, the corporation described in and which executed the above instrument; that he knew the seal of said corporation; that the seal affixed to said instrument was such corporate seal; that it was so affixed by order of the Board of Directors of said corporation, and that he signed his name thereto by like order.

[SEAL.] JNO. H. THOMPSON,
Notary Public, Kings Co., N. Y.

Certificate filed in New York County.

UNITED STATES OF AMERICA,
Southern District of New York, County of New York, ss:

On this 14th day of March, 1906, before me personally appeared John A. Sherer, to me known and known to me to be the individual described in and who executed the foregoing bond, who being by me duly sworn, deposes and says, that he is a resident of the Southern District of New York, and that he is worth the sum of Four hundred dollars ($400) over and above all his debts and liabilities, and he duly acknowledged to me that he executed the same.

ALBERT S. WRIGHT,
[SEAL.] *Notary Public, N. Y. Co.*

752 (Endorsed:) "A" 3825—U. S. Circuit Court, Southern District of New York.—The American Sugar Refining Company of New York, against The United States of America.—Bond.—Parsons, Closson & McIlvaine, Attorneys for Appellant, 52 William Street, N. Y. City.—Approved as to form and also as to sufficiency of sureties, with reservation, however, to the Complainant of the right at any time to examine the proper officers of the Surety Company, under oath, touching its assets, liabilities and financial condition generally. E. Henry Lacombe, U. S. Circuit Judge.—U. S. Circuit Court, Southern District New York, Filed Mar. 30, 1906, John A. Shields, Clerk.

753 THE UNITED STATES OF AMERICA, *ss:*

The President of the United States of America to the United States of America:

You are hereby cited and admonished to be and appear at the Supreme Court of the United States, at the City of Washington, within thirty days from the date of this writ, to wit, on the 27th day of Ap'l, 1906, pursuant to an appeal duly allowed by the Circuit Court of the United States for the Southern District of New York, and filed in the office of the Clerk of said Court on the 29th day of March, 1906, in a cause wherein the American Sugar Refining Company of New York is appellant, and the United States of America is appellee, to show cause, if any there be, why the decree rendered against the said appellant as in said appeal mentioned, should not be corrected, and why speedy justice should not be done the appellant in that behalf.

Witness Hon. E. Henry Lacombe, United States Circuit Judge for the Southern District of New York, this 29th day of March, 1906.

E. H. LACOMBE,
United States Circuit Judge for the Southern District of New York.

(Endorsed:) "A" 3825—U. S. Circuit Court, Southern District of New York.—The American Sugar Refining Company of New York, against The United States of America.—Citation.—Parsons, Closson & McIlvaine, Attorneys for Appellant, 52 William Street, N. Y.

City.—A copy of the within paper has been this day received at this office. Mar. 30, 1906, Henry L. Stimson, U. S. Attorney.—U. S. Circuit Court, Southern District New York, Filed Mar. 30, 1906, John A. Shields, Clerk.

754 UNITED STATES OF AMERICA,
Southern District of New York, ss:

I, John A. Shields, Clerk of the Circuit Court of the United States of America, for the Southern District of New York, in the Second Circuit, do hereby Certify that the foregoing pages, numbered from one to 753 inclusive, contain a true and complete transcript of the record and proceedings had in said Court, in the cause entitled The American Sugar Refining Company of New York, Appellant against The United States of America Appellee (No. 3825) as the same remain of record and on file in my office.

In Testimony Whereof, I have caused the seal of the said Court to be hereunto affixed, at the City of New York, in the Southern District of New York, in the Second Circuit, this 26th day of April in the year of our Lord One Thousand Nine Hundred and six and of the Independence of the said United States the One Hundred and Thirtieth.

[Seal U. S. Circuit Court, South. Dist. New York.]

JOHN A. SHIELDS, *Clerk.*

[Endorsed:] United States Circuit Court of Appeals for the Second Circuit. The American Sugar Refining Company of New York Appellant *vs.* The United States of America Appellee (No. 3825) Transcript of Record from the Circuit Court of the United States for the Southern District of New York.

Endorsed on cover: File No. 20,237. S. New York C. C. U. S. Term No. 281. The American Sugar Refining Company of New York, appellant, *vs.* The United States. Filed May 2nd, 1906. File No. 20,237.

IN THE

Supreme Court of the United States.

AMERICAN SUGAR REFINING COMPANY OF NEW YORK, Appellant, AGAINST THE UNITED STATES, Respondent.	October Term, 1907. No. 25. BRIEF FOR APPELLANT.

Appeal by the importers from a judgment of the Circuit Court of the United States for the Southern District of New York, affirming a decision of the Board of General Appraisers which overruled the protests of the importers against the classification of certain imported sugars.

The question involved is the validity of so much of certain Treasury Regulations promulgated October 27, 1897, as requires imported sugars to be classified for dutiable purposes, not, as the Tariff Act of July 24, 1897, provides, in accordance with "every additional degree [above 75°] shown by the polariscopic test," but besides these, in accordance with certain additional fractions of a degree, shown only in a so-called "Table of Corrections to Polarizations for changes in Temperature," referred to in the regulations. The sugar schedule of 1897 reads:

"209. Sugars not above number sixteeen, Dutch standard in color, tank bottoms, syrups of cane juice,

melada, concentrated melada, concrete and concentrated molasses, testing by the polariscope not above seventy-five degrees, ninety-five one-hundredths of one cent. per pound, and for every additional degree shown by the polariscopic test, thirty-five one thousandths of one cent. per pound additional and fractions of a degree in proportion."

By Treasury Regulations promulgated under this act, the Secretary of the Treasury undertook, as the importers contend, to substitute for the standard of classification provided by the act, to wit, the "degrees shown by the polariscopic test," another and a different standard, to wit, "the percentage of pure sucrose contained in the sugar, as ascertained by polarimetric *estimation*." This intention is specifically avowed in the Regulations themselves as follows (p. 310):

"79. The expression 'testing * * * degrees by the polariscope' occurring in the act, is construed to mean the percentage of pure sucrose contained in the sugar, as ascertained by polarimetric estimation."

Upon the assumption that to convert "the number of degrees shown by the polariscope" prescribed by the act into "the percentage of pure sucrose contained in the sugar," prescribed by the Treasury Regulations, it is necessary to add to the former certain fractions of degrees, varying in accordance with the temperature at which the test was taken, these regulations set forth a table of additions to the observed polariscopic test which are required to be added to it in order to obtain the number of degrees at which the sugar shall be classified for dutiable purposes.

History of the Litigation.

The litigation over the validity of these regulations has been pending in the Courts ever since the January following the original promulgation of the egulations in October, 1897. Certain cargoes of

sugar imported during that month by Bartram Bros. and Howell Son & Company at the port of New York by the steamers *Cameo* and *Santiago*, were classified and assessed for duty under the Treasury Regulations in question at a certain fraction of a degree higher than that shown by the polariscopic test by the addition prescribed by the regulations in question. The importers protested and appealed to the Board ef General Appraisers, by whom the protests were overruled in March, 1899 (Treasury Decisions, 2850–G. A., 4386). From the decision of the Board of General Appraisers overruling their protests the importers appealed to the Circuit Court of the United States. In that court much additional testimony was taken, and in May, 1903, the Court, the Hon. William K. Townsend, presiding, handed down a decision sustaining the contention of the importers, holding the Treasury Regulations in question invalid, and reversing the decision of the Board of General Appraisers (Bartram Bros. *v.* U. S., 123 Fed. Rep., 327).

Opinion of United States Circuit Court in favor of Importers.

The opinion of the Court was in part as follows:

"The question presented is whether the Treasury Department was justified in so interpreting the Statute of 1897 as to provide that 'testing by the polariscope' should mean a correction of such tests by figures, which, under varying temperatures, would show an inaccurate, but more nearly accurate, percentage of the amount of sucrose in a sample than was shown by the tests which, except under the Bounty Act, had universally prevailed in this country for upwards of twenty years. I think the end sought does not justify the means used. The well settled meaning which 'testing with the polariscope' had at the time of the passage of the act, could not thus be violently changed by mathematical 'corrections and additions,' without evidence that Congress intended such a change. Especially must this be so, when, as in this case, the use of the table not

only does not necessarily produce actually accurate results, but leads to the statement of chemical impossibilities."

Reversal by Circuit Court of Appeals.

From the judgment of the Circuit Court in favor of the importers, an appeal was taken by the Government to the Circuit Court of Appeals for the Second Circuit. In that Court, in June, 1904, the decision of the Circuit Court was reversed, and that of the Board of General Appraisers affirmed (United States *v.* Bartram Bros., 131 Fed. Rep., 833). The grounds upon which the decision of that Court proceeded were, first, that the requirement of the regulations, that the observed polariscopic test should be increased by the additions prescribed by the table according to the temperature at which the test should be taken, could be properly regarded merely as prescribing a "particular method of conducting such a test," which, rather than some other method, the Secretary of the Treasury was competent to adopt "under the general power to make regulations not inconsistent with law granted to it by Section 251, Revised Statutes U. S." (U. S. Compiled Stats., 1901, p. 138); and secondly, that therefore "there is but a single question presented which is determinative of the case, to wit, whether Congress used the words 'testing by the polariscope' and 'shown by the polariscopic tests' with some special trade meaning which would confine them to a particular method of conducting such tests"; as to which point it stated its conclusion as follows:

"Therefore, when Congress passed the Tariff Act now under consideration, it knew that the Secretary had made regulations as to polariscopic tests; that he had varied them from time, presumably to secure more accurate results; that some times he had directed that additions to the readings should be made for changes of temperature; that at other times he had not required such additions to be made. It seems a reasonable conclusion that Congress, when

it passed the Act of 1897 containing merely the phrase 'testing by the polariscope,' without any further directions as to such test, without approval or condemnation of either of the variant methods of conducting it, which the Treasury Department had therefore prescribed for imported as well as domestic sugars, intended to leave all details as to selection of instrument, employment of experts and instruction as to method, to the sound discretion of its Secretary."

Here, it should be noted, whatever may be said for or against the justice of its views upon the other questions discussed, the Circuit Court of Appeals inadvertently fell into unquestionable error upon two points:

1. That the Secretary of the Treasury had, even before the Act of 1897 was passed, "directed that additions to the reading should be made for changes of temperature" for imported as well as domestic sugars.

On the contrary, such a thing as any correction whatever of the observed polariscopic test of imported sugars had never, before October, 1897, been heard of in the Treasury Department or elsewhere.

2. That "there is but a single question presented which is determinative of the case, to wit, whether Congress used the words 'testing by the polariscope' and 'shown by the polariscopic test' with some special trade meaning which would confine them to a particular method of conducting such test."

On the contrary, though this question was presented as a subordinate one, the contention of the importers was, and is, five-fold, viz.:

1. That when Congress enacted that sugars should be classified for duty according to the "number of degrees shown by the polariscopic test," it did not mean that they should instead be classified for duty,

as the Secretary of the Treasury ordained, according to the "percentage of pure sucrose contained in the sugar"; whether "as ascertained by polarimetric estimation" or by polarimetric estimation plus certain additions, assumed to be necessary to correct errors in the polarimetric estimation in order to arrive at the percentage of pure sucrose contained in the sugar.

2. That after "the polariscopic test" has been made, an addition to "the number of degrees shown by the polariscope" of some extraneous factor not shown by it is not "a particular method of conducting such test," but is a substitution for it of an entirely different standard of classification of sugars, not prescribed by Congress.

3. That no amount of trade usage or Treasury Department usage could suffice to sanction the substitution by the Treasury Department for the dutiable standard of imported sugars prescribed by Congress, of a different standard, whether it more nearly approximate to the "percentage of sucrose contained in the sugar," or not.

4. But if the making of an addition to the "degrees shown by the polariscope" or other degrees or fractions of a degree shown only by a Table of Correction Factors, could by possibility be regarded as merely "a particular method of conducting such test," it was an absolute innovation upon the method of subjecting imported sugars to the polariscopic test which, in the language of the Circuit Court, "had universally prevailed in this country for upwards of twenty years," both in the Treasury Department itself and in the trade, and under statutes practically identical in language with that of 1897, and could not have been the one intended by Congress.

5. That even if the Secretary of the Treasury has the power to "correct" the standard of classification

prescribed by Congress for imported sugars, by making such an addition to it as well make it approximate more nearly to the "percentage of sucrose contained in the sugar," he has not the power to make an addition to the prescribed standard, which, as found by the Circuit Court, "not only does not necessarily produce actually accurate results, but leads to the statement of chemical impossibilities," to wit, the constant importation of entire cargoes of sugar, all by several fractions of a degree *more than chemically pure.*

Decision on Application for Certiorari in Bartram, &c., Cases.

Upon the entry of the judgment of the Circuit Court of Appeals reversing the Circuit Court and sustaining the Board of Appraisers, the importers in November, 1904, filed a petition in this Court for a writ of *certiorari* to review the judgment of the Circuit Court of Appeals. The petition was denied (*Bartram* v. *U. S.*, 195 U. S. 635), without an opinion; and, therefore, so far as the importers are advised, not improbably for the reason that the question presented being the validity of the regulations adopted by the executive branch of the Government, and "the construction or application of the Constitution of the United States" being therefore involved, it was one in which the judgment of the Circuit Court of Appeals was not final, and was therefore not one in which this Court was authorized to issue a writ of *certiorari* (26 U. S. Stats., 828, Section 6, Clause 2).

Appeal to Supreme Court in this Case.

The importers, thereupon, in January, 1905, took an appeal to the Circuit Court from decisions of the Board of General Appraisers overruling similar protests in the case of some ten importations of sugar during the months of June, July and August,

1904, where the additional duties exacted by virtue of these Treasury Regulations alone amounted in all to over $5,600 (p. 5). Upon this appeal, the Circuit Court, reversing its former decision in obedience to the controlling decision of the Circuit Court of Appeals, affirmed the decision of the Board, without argument or opinion, in December, 1905 (p. 692); and from this judgment of the Circuit Court, as rendered in a case "involving the construction or application of the Constitution of the United States," the importers have now taken this appeal direct to this Court (26 U. S. Stats., 827, Section 5; as amended, 29 U. S. Stats., 492).

Statement of Questions.

The questions arise under the Sugar Schedule of the Tariff Act of July 24, 1897, and certain provisions of the Treasury Regulations, promulgated October 27, 1897, as revised February 17, 1899, "governing, sampling and classification of imported sugars and molasses" under that act.

That pertinent language of the sugar schedule is as follows:

"209. Sugars not above number sixteen, Dutch standard in color, tank bottons, syrups of cane juice, melada, concentrated melada, concrete and concentrated molasses, testing by the polariscope not above seventy-five degrees, ninety-five one-hundredths of one cent. per pound, and for every additional degree shown by the polariscopic test, thirty-five one thousandths of one cent. per pound additional and fractions of a degree in proportion."

The pertinent feature of the Treasury Regulations to which the importers objected is a requirement—for the first time in the use of the polariscope in the United States, either by the buyers and sellers of imported sugar, or by the Treasury Department in assessing duties upon it—of an arbitrary addition to

the observed polariscopic test, the amount of the addition increasing with the temperature at which the test is taken.

The Polariscope and its Use.

The "polariscope" is an instrument for observing and measuring the effect of different translucent media upon a ray of polarized light. Light is said to be polarized when, as the effect of having passed through a transparent medium having that specific power, all its transverse vibrations, which in the normal ray take place in all planes, take place in but one plane. Certain translucent substances, among them quartz and solutions of sugar, possess the property when a ray of polarized light is transmitted through them, of twisting or rotating this plane of polarization, *i. e.*, the plane along which the vibrations in the ray of polarized light take place. The amount of this rotation is different with different substances and constant with each. For example: The same thickness of a solution of the same amounts of chemically pure sugar and water will always rotate the polarized ray of light the same amount. "The polariscope" referred to in the Act of Congress and in question here is one so adjusted that when the tube through which the ray of polarized light passes is filled with the standard solution of chemically pure sugar; and the two colors, into which the circle of light apparent to the observer at the eye-piece is by the effect of the polarization and rotation divided, are by adjustment of the quartz wedges at the eye-piece brought to the same tint, the so called Ventzke scale by the eye-piece indicates one hundred degrees; while under the same circumstances, if the same standard solution of impure sugar, viz., one containing only a certain percentage of pure sugar, be substituted, the Ventzke scale will indicate an approximately corresponding percentage.

The "Polariscopic Test" a familiar and definite term at and long before the time when the Act of Congress was passed in the United States.

The reference in the Act of Congress in question to "the polariscopic test" was, as would be inferred from the manner of it, a reference not to a new thing, but to something supposed to be well understood at the time. The earliest commercial use in this country of the polariscope and the polariscopic test disclosed by the testimony was by Dr. Edward Sherer, one of the witnesses for the importers. He was professionally engaged in New York as a trade chemist in testing sugar by the polariscope, from 1872 down to the time when he entered the Government employment in 1880 (p. 446). It is in fact part of the history of the polariscopic test in this country that Dr. Sherer was almost, if not quite, the first to introduce it into commercial use.

The three trade chemists who between them test practically all the sugar imported at the Port of New York, John A. Sherer, George Grund and Morris Hasenclever, testified, as witnesses for the importers, that they had been engaged as trade chemists testing sugars by the polariscope for twenty, seventeen and sixteen years, respectively, *i. e.*, since 1880–5 (pp. 37, 424, 440).

The sugar chemist who tests practically all the sugar imported at the Port of Philadelphia, Gottfried Lansman, and the two trade chemists who test all the sugar imported at Boston, Frank W. Bennett and Prof. S. B. Sharples, similarly testified, as witnesses for the importers, that they had been using the polariscopic test for twenty-five years, *i. e.*, since 1876 or 1877 (pp. 429, 430, 433, 437).

When the Tariff Act of 1897 was passed "the polariscopic test" had, accordingly, been in commercial use for some twenty years as a method of test-

ing sugar in the three ports of this country to which nearly all imported sugars come. A more significant fact is that it had likewise then been known to and employed both by Congress and the Treasury Department for nearly fifteen years; to wit, since the passage of the Tariff Act of March 3, 1883. That act contained the following provision:

SEC. 2502. "All sugars not above No. 13 Dutch standard in color shall pay duty on their polariscopic test as follows, viz.:

"All sugars not above No. 13 Dutch standard in color, all tank bottoms, syrups * * * testing by the polariscope not above seventy-five degrees shall pay a duty of one and forty hundredths cent per pound and for every additional degree or fraction of a degree shown by the polariscopic test they shall pay four hundredths of a cent per pound additional."

Under the provisions of this act there were promulgated the Treasury Regulations of May 22, 1883 (pp. 155, 158-160), containing the following provisions:

"SECTION 30. When the samples have reached the classification room in the appraiser's office * * * if found to be not above Number 13 Dutch standard in color, they shall be subjected to *a polariscopic test* for duty *as hereinafter provided.*"

"SECTION 34. * * * Should the results of the two separate tests of the sample agree within three-tenths of one per cent., the lower of the two shall be accepted as the test for classification."

"SECTION 35. Should the results not agree within three-tenths of one per cent., a third test of the sample shall be made, and of the three tests so made the lower of the two most closely agreeing shall be accepted as the test for classification, provided the said last mentioned tests agree within three-tenths of one per cent."

"SECTION 50. The following instructions in regard to the use of the polariscope in the testing of sugar and molasses and the adjustment and care of the instrument, *prepared and revised by* MR. EDWARD SHERER [to wit, the witness for the importers above referred to], chemist in the United

States appraiser's office at New York, are appended for the information of appraising officers:

"Directions for testing sugar by the polariscope:

"1. Mix the sample thoroughly and uniformly, crushing all lumps.

"Weigh accurately in the German silver dish provided for the purpose, 13.024 grams of the sample to be tested. Should the counterpoise not exactly balance the dish, small pieces of tin-foil should be used. Care should be taken to accurately balance the dish before each weighing. Wash the sugar from the dish into a 50 c. c. flask with the aid of the washing bottle, taking care that every particle of sugar is transferred to the flask, which should not be more than two-thirds full when all is in. Wash down into the flask any grains that may adhere to the neck, using as little water as possible for this purpose. Take the flask by the neck, between the thumb and forefinger, and shake gently in one direction, causing the liquid to rotate in the flask till the sugar is in solution. The body of the flask should not be handled, as the heat of the hand will increase the temperature of the solution.

"To determine when the sugar is in solution, hold the flask to the light and shake gently, when any crystals of sugar not dissolved will be readily detected at the bottom of the flask. Wash the neck of the flask again with the washing bottle, to carry down any particles that may have been spattered up in the process of shaking.

"3. Sabacetate of lead is now to be added to the solution in the flask, drop by drop, till no further precipitate is formed. When sufficient has been added, the lead solution will settle clear at the bottom of the flask. From twenty to sixty drops, or from one to three cubic centimetres, will answer for sugars. For molasses, five cubic centimetres is the maximum amount needed. An excess of the lead solution is to be avoided, as it causes turpidity in the solution, by reason of the precipitation of fine particles of carbonate of lead which pass through the filter and render the solution opaque when placed in the observation tube. The lead solution is most conveniently added by means of a Berlin flask and siphon tube, with rubber connection and pinch-cock. Care should be taken to keep the air from the flask, by means of a glass rod in the end of the rubber tube, when not in use, as the ac-

cess of air causes the precipitation of carbonate of lead.

"4. The flask should now be filled to within half an inch of the neck with the washing bottle. A drop of ether added from a small bottle will remove all air-bubbles, that would otherwise interfere with the accurate filling of the flask to the mark. After the addition of the ether, fill the flask to the mark by adding water, drop by drop, from a Berlin flask, with similar attachments as the flask used for the lead solution. The flask containing the sugar solution should be so held that the line will be on a level with the eye, and should be filled till the bottom of the curve at the surface of the liquid or meniscus is even with the line.

"5. Place the thumb over the neck of the flask and shake well and filter into a clean, dry cylinder jar (glass.) Should the solution be dark in color, two or three small spoonfuls of pulverized bone-black should be placed in the cylinder, and the solution well shaken and again filtered. The bone-black used for this purpose should be previously dried at a temperature of 140° to 160° centigrade and kept under a desiccator, as it readily absorbs moisture, and its use in a moist state would increase the volume of the solution and make the result of the test too low. Screw the cap with rubber washer and glass plate on one end of the observation-tube, taking care that the glass plate shall press lightly on the end of the tube; then pour the clear, light-colored solution into the tube till it slightly overruns the end. Slide the glass plate over the end, so as to avoid getting any bubbles of air under it, and screw on the cap.

"6. Place the tube in the instrument and turn the thumb-screw underneath to the right or left till the colors are blended. By turning the screw at the right-hand side of the instrument, the degree of light is regulated so as to obtain the shade at which the colors are plainest. All the shades can be obtained by turning his screw halfway round in both directions; and it should not be turned completely around in one direction, as this would be liable to get the instrument out of adjustment. When the colors are equalized, the percentage can be read from the scale by observing the position of the zero. The tenths are ascertained by counting the lines to the right of the zero, on the upper or vernier scale, till a line is found to make one uniform vertical line

with a line on the lower scale. Repeated observations with variation of shade, by the use of the screw at the right, should be made before accepting the result as correct."

The foregoing instructions constitute a detailed description of the method of testing sugars by the polariscope, which was then employed and has ever since been consistently employed by all sugar chemists in this country and other countries engaged in the business. It is the one referred to in the testimony as the "commercial test." Down to and for some time after the passage of the Tariff Act of July 24, 1897—to wit, for a period of over *fourteen years*—this method was likewise the method, and the only method, employed by the Treasury Department itself in classifying and assessing duty upon imported sugars. The result obtained by this method was at that time, at least, absolutely the only meaning which any one in the United States connected with the business of importing sugars, whether as buyer, seller, trade chemist or appraiser, could attach to the words "the polariscopic test."

The Evidence.

It is upon this point absolutely clear and uncontradicted. The error already referred to, into which the Circuit Court of Appeals inadvertently fell with regard to it, is explained hereafter in the discussion of the Internal Revenue Regulations of 1892.

Whatever room for doubt upon this subject there may have been upon the evidence before the Board of Appraisers, there was none upon that before the Circuit Court or the Circuit Court of Appeals. The importers were there able to establish the fact out of the mouths of the very trade chemists who had actually done the testing. The Government was unable to adduce proof of a single instance in which, prior to the adoption of the Regulations of 1897, a pound of imported sugar had ever been bought or

sold, or classified or valued for the assessment of duty by any other polariscopic test than that obtained by the so-called "commercial method." A summary of the evidence on this point is given in "Appendix A" annexed to this brief.

The "polariscopic test" of sugar, necessarily and avowedly an intrinsically different thing from the "percentage of sucrose" content of sugar; and universally recognized as only a conveniently ascertained approximation to what can be learned exactly only by chemical analysis or the Clerget test (pp. 338, 339).

Every polariscope is graduated for business by a purely empirical process. When the instrument is complete but for its "Ventzke" scale, a definite weight (=6.048 grams) of sucrose (*i. e.*, chemically pure sugar ascertained to be such by other means than the polariscope—the method employed will be found described at page 615) is dissolved in a definite volume (100 Mohr. Cubic Centimetres) of distilled water at a definite temperature (17.5° Centigrade), the tube of the polariscope filled with this solution, the quartz wedges constituting the eye-piece moved back and forth by a delicate thumb-screw until the two differently colored halves of the field of vision appear to the observer to have been brought to precisely the same tint. The point then indicated by the index of the instrument upon the scale is marked 100°.

A solution is then made of precisely one-half of the same or "normal" weight (viz., 13.0249.) of the same pure sugar. This is dissolved in precisely the same quantity of distilled water, at precisely the same temperature, as before. The polariscopic tube is then filled with this solution, and the two halves of the field of vision brought into perfect

accord as before. The point then indicated by the index upon the scale is marked 50°. The intervening space on the scale between the mark of 100° and 50° is then divided into fifty equal spaces, each indicating one degree of the scale, and each of these again into tenths, indicating one-tenth of a degree.

When this instrument, thus equipped, is set up in the laboratory of a sugar chemist, whether employed by the Government or the trade, and a solution of the commercial sugar which it is desired to test is prepared in the way described above, to wit, 26.048 grams of the sugar dissolved in 100 Mohr. Cubic Centimetres of distilled water, and the polariscopic tube filled with this solution and the two halves of the field of vision brought into accord by the operator, the index of the scale will point to a certain figure upon the scale, somewhere between 50° and 100°, say, 87.5°. This figure, at which the index of the scale thus points, *the polariscope thus affirms to be the "polariscopic test of the sugar."*

Neither the polariscope, nor its maker nor its operator on behalf of it, makes any affirmation that this figure is the "percentage of sucrose content" of the sugar. If cross-examined on this point, the only affirmation about it which the polariscope, its maker or operator could undertake to make, would be a purely hypothetical one, involving many assumptions, some of which will be known to be contrary to the fact, and as to others of which it cannot be known whether they are true or false.

The answer would run something like this:

"Assuming (1) that the impurities constituting the 12.5 per cent. of non-sucrose are all optically inactive:

"Assuming (2) that this percentage of impurities is of the same specific gravity as sucrose;

"Assuming (3) that the weight of sugar and the volume of water have been measured with the same accuracy as when the instrument was standardized;

"Assuming (4) that equal care has been taken as when the instrument was standardized to prevent

any evaporation of the solution during the process and its consequent concentration and increase of optical power;

"Assuming (5) that the standard solution of the sugar has not been concentrated and consequently made more optically active by the displacement of any of the water by foreign substances like acetate of lead (customarily added to raw sugar to clarify the solution sufficiently to made it possible to see through it);

"Assuming (6) that notwithstanding any difference of temperature between that at which the sugar is polarized and that of 17.5° C., at which the instrument was graduated, there has been no expansion or contraction either of the glass flask in which the volume of solution is measured or of the polariscopic tube itself, or of the brass scale or of quartz wedges by which the amount of the rotation is measured;

"Assuming (7) that as the quartz wedges are moved back and forth to bring the two halves of the field of vision into accord, the eye of the operator and the eye of the maker who standardized the instrument would agree exactly as to the instant when that result was attained and would therefore stop the index of the scale at exactly the same point;

"Yes—otherwise, No."

In practice, as to many of these assumptions, it cannot be known whether they are true or false. As to others, it is known that they are always false.

1. It is not known in practice that the impurities in the solution are not optically active; *i. e.*, having the power of rotating one way or the other the polarized ray of light. On the contrary, it is known and affirmed by the Government as well as by the importers, that among these impurities there are frequently substances, *e. g.*, "raffinose," "invert Sugar," and "caramelization products" which do affect the polarity of the sugar. (Dr. Wiley, pp. 98, 105, 107, 108; Dr. Weichmann, p. 150; Dr. Wolfbauer, pp. 339, 340; Prof. Harrison, p. 351).

2. No test is ever made to determine the relative specific gravity of the impurities of the sucrose. Obviously, if the specific gravity of the impurity is greater or less than that of the sucrose, the percentage of sucrose contained in the given weight of 26.048 grams, will vary, and the sample polarize higher or lower accordingly.

3. It is seldom, if ever, true that in practice the weight of the sugar and the volume of the water are measured with the accuracy employed when the instrument was standardized (p. 94).

This is sufficiently apparent from the very elaborateness of the regulations prescribed for the Government chemists, by which this end is sought to be obtained.

"The dish being well rinsed three or four times and the rinsings added to the contents of the flask" (p. 313).

"The water used must be either distilled water or clear water which has been found to have no optical activity" (*Id.*).

"The flask should be held by the neck with the thumb and finger, and the bulb not handled" (*Id.*).

"Care must be taken that no particle of the sugar or solution is lost" (*Id.*).

"The funnel and the vessel used to receive the filtrate must be perfectly dry.

"The first portion of the filtrate should be rejected entirely, as its concentration may be affected by a previous hygroscopic moisture content of the filter paper" (p. 315).

"Before filling the tube it must either be thoroughly washed and dried or rinsed several times with a portion of the solution itself" (p. 316).

4. It is equally untrue that in practice the same care is taken as when the instrument was standardized to prevent any evaporation of the solution during the process, and its consequent concentration and increase of optical power.

The ever present danger of carelessness on this

point likewise is apparent from the minuteness of the regulations devised to guard against it.

"Care must be taken that the operations for mixing and weighing are not unduly prolonged; otherwise the sample may easily suffer considerable loss of moisture, especially in a warm room" (p. 313).

"A watch glass is placed over the funnel during filtration to prevent a concentration of the solution by evaporation" (p. 315).

"Unnecessary warming of the tube by the hands during the filling should be avoided" (p. 316).

"*The following principal sources of error must be especially guarded against:*

1. Drying of sample during weighing.

2. Excess of subacetate of lead solution in clarification.

3. Incomplete mixing of solution after making up to mark.

4. Imperfect clarification of filtration.

5. Concentration of solution by evaporation during filtration" (p. 317).

5. In every raw sugar, according to the Treasury regulations, the standard solution of the sugar is concentrated and made more optically active by the displacement of a portion of the water by acetate of lead, alumina cream, and sometimes bone black added "for the purpose of clarifying the solution."

"'Most sugar solutions, however, will require the addition of a clarifying or decolorizing agent in order to render them sufficiently clear and colorless to polarize.' In such case, before making up to the mark, a solution of subacetate of lead is added" (p. 314).

"*A decided excess of subacetate of lead solution should never be used.*" (Italics in the original.) (p. 314.)

"The use of subacetate of lead should, in all cases, be followed by the addition of 'alumina cream,' in about double the volume of the subacetate solution used for the purpose of completing the clarification," &c. (p. 314).

"If the solution be still too dark to polarize * * * it may be decolorized by means of bone black. The

use of this clarifying agent should be avoided if possible, however, on account of its well-known property of absorbing sugar" (p. 315).

6. In this country the polarization is rarely, if ever, taken at the temperature of 17.5° C. (equal to 63.5 Fahr.). The temperature of the laboratories in the winter is about 22° or 23° C. (71.6° or 73.4° F.) (p. 472). In summer it varies of course with the outdoor temperature say from 65° to 95° F. Consequently, contrary to the assumption of the hypothesis on this point there has always been an expansion or contraction of the glass flask in which the volume of solution is measured, of the polariscopic tube itself, of the brass scale and of the quartz wedges by which the amount of the rotation is measured.

Quartz, brass and glass, like all other substances, expand as they are heated. The effect of this expansion of the quartz wedges is, that in order to obtain the thickness of quartz requisite to rectify the rotation by the sugar solution of the ray of polarized light, it is necessary to push the wedges together to a less extent than if they were at a lower temperature, and consequently smaller in bulk. The reading of the scale will, therefore, be too low by an amount in proportion to the amount of the expansion of the wedges. This, in turn, is in proportion to the increase of the temperature over the standard temperature. The amount of this expansion of the quartz wedges and of the brass scale under heat and the different fractions of degrees Ventzke which should be added to the observed reading of the Ventzke scale, if it is desired to ascertain approximately what would have been the reading at the standard temperature without actually taking the polarization at that temperature, were many years ago calculated and reduced to a formula known as Jobin's formula. There is absolutely no disagreement between any scientist or any witness in this case, either for the Government or for

the importers, as to the necessity of this use of Jobin's formula, when a solution of sugar to which no clarifying re-agents have been added is polarized at temperatures above 17.5° C.; and it is desired to attain not its "polariscopic test" but as nearly as may be its "true sucrose content."

Dr. WIECHMANN:

"The formula reads: 'Polarization: + [0.00016T] N.' In this formula the 'T' stands for the difference in temperature at which the sugar solution is prepared and polarized and the temperature at which the saccharimeter has been graduated. 'N' stands for the number of degrees read off on the polariscope when the observation is being made * * * The object of this formula is to correct for the change in optical value which the quartz wedges and polariscope experience on being brought to a temperature different from that temperature at which the instrument was graded.

"Q. What is the physical effect of the increased temperature upon the quartz wedges? A. An expansion. * * *

"The result of this influence of temperature on the quartz wedges is to bring about an apparent decrease in the reading of the sugar value of the solution which lies in the tube of the polariscope.

"Q. Is there among scientists any difference of opinion upon the point that temperature does exercise an effect upon the polarizing power of quartz plates? A. To my best knowledge and belief, there is not.

"Q. It is unanimously recognized that that is true? A. As far as I know, it is true.

"Q. And is Jobin's formula recognized among scientists as the proper correction for that error? A. As far as I know, it is.

"Q. Have you ever known it questioned? A. I have not.

"Q. What is the history of Jobin's formula? A. This formula called Jobin's formula is essentially the same as the formula by Joubert.

"Q. Have you not been informed that the difference between Jobin's and Joubert's formula is simply that Jobin's formula takes into considera-

tion also the expansion upon the brass scale? A. I have been so informed" (p. 455).

Dr. Harvey W. Wiley, witness for the Government:

"Q. What is the Jobin's correction referred to there? A. The magnitude of that correction is given on page 33. * * *

"The formula is exactly right. I have consulted Jobin's original paper and the formula given by Dr. Wiechmann is exactly the one given by Jobin himself. It makes a correction of .16 for each ten degrees of temperature" (pp. 420, 421).

Professor J. B. Harrison, witness for the Government:

"The rotary power of quartz for light increases with the temperature, thus requiring a greater weight of sugar to produce a definite degree of rotation at high temperatures than at low ones. * * * The effects of these errors can easily be calculated" (p. 347).

"We have taken into consideration the question as to the alteration in the rotatory power of the quartz plate, * * * due to the fact that as the temperature rises the rotatory power changes. * * * The rotatory power will increase slightly in the quartz. That has been known for very many years" (p. 353).

"Q. How much does the quartz plate increase in the same degrees [*i. e.*, 10°]? A. My determinations, I think, are .15 to .19" (p. 354).

In practice it should be noted that even the change by Jobin's formula of the observed polariscopic test is never made; and the trade chemist knows nothing of it. The reason is that the minus error it is designed to correct, is in practice more than corrected by the plus error occasioned by the undue concentration of the raw sugar solutions by the addition of the clarifying agents already referred to.

The following testimony upon this point is absolutely without contradiction in the case:

Edward Sherer:

"In the case of raw sugars, which chiefly were tested by the Government chemists, the error due to the expansion of the quartz wedges was fully compensated for by the concentration of the solution, owing to the use of clarifying re-agents. * * * In the case of a sugar containing very great impurities, the concentration would be necessarily greater, because the precipitate caused by the use of the lead would be greater, and it would be more than compensation for this error [for the expansion of the quartz wedges] in this case; and in the case of a sugar containing a very small amount of impurities the amount of subacetate of lead would be very much less, the concentration of the solution would be, therefore, very much less; but in any case it would be sufficient to compensate for the error representing Jobin's correction in the case of refined sugar, where no clarifying agent was used.

"Q. What compensates for the error in pure sugar? A. The use of Jobin's correction would be compensation" (p. 449).

Dr. Wiechmann:

"In the preparation of the solution of this last-named sugar [a commercial sugar] we are obliged to introduce clarifying agents into the solution. These clarifying agents produce a precipitate in the solution, and, therefore, occupy part of the space that should be occupied by the solution. The unavoidable sequence of this is that the solution is more concentrated than it should be, and the reading that such solution returns is higher than it should be. I therefore hold that this unavoidable error caused by the precipitate in one direction far more than offsets the decrease caused by the influence of temperature upon the quartz wedges of the instrument" (p. 464).

7. As to the last of these assumptions, it is, contrary to it, an admitted fact that the polariscope cannot be read with accuracy within 0.2° V or 0.3° V.

In other words, successive readings of the same solution by the same observer or by different observers will vary by at least this amount; for the reason that the blending of the two halves of the illuminated disk will at times appear to be equally perfect to the same observer or to different observers at different points within this limit. For this reason a difference between polarizations varying from each other by less than 0.2° V. is considered negligible; and the polarizations are regarded as identical.

Treasury Regulations of February 17, 1899:

"A variation of 0.2 from the established values may be allowed for errors of observation, temperature, &c.; but in the hands of a careful observer, a deviation greater than this, after a careful setting of the zero, shows that the instrument is not accurately adjusted" (p. 332).

Internal Revenue Regulations of August 18, 1892:

"A variation of .3 from the established values may be allowed for errors of observation, temperature, etc." (p. 216).

Ernest W. Chapman, Sugar Examiner for the Government:

"Q. Mr. Chapman, what is the practice in the Laboratory in regard to tests where one operator makes a test and another makes a different reading from the first one taken? What is the manner of doing that? A. Each man reads his tube, marks the number down on the ticket. The result must agree within .3 per cent. If not, * * * we make a retest, and if it is more than .3 we make a third test" (pp. 71, 72).

Harvey W. Wiley:

"Under the regulations of 1883, an allowance of .3 was permitted between readings as admissible, and the new regulations, which are only a modification of the old, continue this allowance. This allowance is permitted because the polarizations of sugar in the Appraiser's laboratory is not a scientific operation. *It is not performed with absolute accuracy.* Such a variation would not be permitted in scientific determinations, but it is permitted in commercial operations" (p. 94). * * * "I may add that an observer may polarize a given solution 100.2, which would have been polarized under normal conditions at exactly 100 by another observer.

"Q. Is there also an allowance for inaccuracies for the observer in these regulations of 0.3? A. I wish to correct my former statement. I said that the present regulations had the same variations as the former ones, that is .3. With these present regulations we do not need as great a variation, because we think that our system is more accurate, therefore, a less variation is permissible than .3, and the new regulations permit only .2 in ordinary commercial work" (p. 99).

The recent and still pending conflict of opinion as to the existence of still another source of inaccuracy in the polariscopic test as a Measurement of Sucrose Content, viz., the alleged decrease under heat of the rotatory power of sucrose.

It has been seen that the polariscope and the "polariscopic test" are and have always been known to be incurably inaccurate as a means of determining the exact percentage of sucrose content of sugar; though at the same time doubtless the most nearly exact of any method commercially practicable of execution which was known at the time that it was prescribed by Congress in the Act of July, 1897.

The unavoidable and uniformly recognized sources of error are those already pointed out, to wit, chiefly the "personal equation" of the operator, which confessedly makes an error of .2 degrees V., or .3 degrees V., a negligible one,—the nicety of the various precautions requisite in weighing, measuring, clarification, filtering and decanting the solution, all impossible of absolute attainment by ordinary operators and ordinary work; the raising of the test consequent upon the concentration of the solution caused by the addition of the necessary clarifying agents; and the lowering of the test by the expansion of the different parts of the instrument by any heat above 63.5° F.; the last two sources of error counterbalancing each other to a degree within the permitted error in observation of .2 or .3 degrees V.

For some years before the adoption of the Treasury Regulations of October, 1897, the possibility of the existence of still another source of error had been mooted among sugar chemists; and over it the battle of experts had been brewing which has been fought out in this case with a characteristic ardor on both sides, perhaps somewhat disproportionate to its actual importance as an issue.

This is the assertion, alternately made and denied by each successive investigator, that the rotatory power of sucrose upon the polarized ray of light itself varies inversely with the temperature of the solution containing it, decreasing with heat, increasing with cold. This alleged effect of varying temperatures upon the rotatory power of the sucrose itself, if it exists, is, of course, a source of error wholly independent of the mechanical effect of heat upon the polariscope itself in expanding the quartz wedges, index plate, etc., which has always been known and which can be approximately corrected, if desired, by the use of Jobin's formula.

The first appearance in the Treasury Department of the practice of making arbitrary additions to the polariscopic test. The introduction of this practice into the Internal Revenue Bureau of the Treasury Department, not by any sugar chemist, but by "an engineer by profession," the "Assistant Superintendent of the Coast Survey" (pp. 370-371). The use of the practice by that bureau from 1892 to 1894 to swell the amount of bounties payable under the Act of October, 1890.

The existence or non-existence of this new source of inaccuracy in the polariscopic test as a measurement of exact sucrose content, was, as it still is, a moot point, when upon the passage of the tariff act of October, 1890, the Internal Revenue Bureau was called upon to promulgate regulations for ascertaining by the polariscopic test the amount of the bounties payable on domestic sugars under that act. The framing of these regulations was referred to a commission consisting of Dr. Harvey W. Wiley, Chief Chemist in the Agricultural Department; O. H. Tittman, of the Coast and Geodetic Survey, the officer in charge of weights and measures; and Charles A. Crampton, Chemist of the Internal Revenue office (p. 113). Prof. Wiley, in giving his assent to these regulations, as he was obliged to explain upon the witness stand in the present trial, relied chiefly upon the work of Mr. Tittman (p. 101); as he himself was unfortunately as long afterwards as January, 1897, three years later still, on record in his book on Agriculture Analysis (pp. 100, 101) as stating that "temperature had very little influence upon the "results of polarization of sugars" (pp. 99, 100)

" was negligible" (p. 101). "At that time" (to " wit, January, 1897, the witness says, "I had " not investigated the subject myself from that " point of view" (p. 100). The second member of the commission, Mr. Crampton, likewise admitted that he likewise had not personally participated in the experiments (p. 116), and, indeed, testified in so many words that the innovations of these regulations " were based upon the recommendations of Mr. Tittman" (p. 123).

Now Mr. Tittman, though of undoubted eminence in his own profession as an Engineer and Assistant Superintendent of the Coast Survey (p. 370) was, by his own confession, without training or experience, as a sugar chemist or polariscopist (p. 370). "In the line of duty," however (p. 370), he thereupon made certain studies and observations of the polariscope, and happened in the course of them to espouse the new hypothesis of the diminution of the rotatory power of sucrose under heat. He determined the variant thus caused including the already known variant due to the expansion of the quartz wedges, &c., under heat to amount to about .03° V for each 1° C., and constructed a table which was embodied in his regulations calling for a "correction" of the observed polariscopic test by the arbitrary addition to it of .03° V. for each degree Centigrade by which the temperature at the time of the polarization might exceed the 17.5 C. at which the polariscope was graduated.

A *correction* of about .03° Ventzke has to be made (p. 371).

"A sugar solution polarizes 80.5, the control plate just before giving a polarization of 91.4, the temperature of the room during above observations being 25° C. According to the table the value of the control plate at 25° C. is 91.7; the reading is therefore .3 too low, *and .3 is added to the reading* of the sugar solution, making the corrected result 80.8" (instead of 80.5) (p. 216).

The record of the experiments with the polariscope made by this distinguished "Engineer," was embodied in a report made by him to the Government, which the counsel for the importers formally requested the counsel for the Government to produce (p. 375). It was not produced. To Mr. Tittmann's report, Dr. Wiley, although himself then and for some three years later a champion of the opposite theory, gave an inadvertent, and Mr. Crampton an admittedly perfunctory, concurrence. Mr. Tittmann's regulations thereupon went into and remained in effect for two years until the Act of August, 1894, which repealed the Act of October 1890, and its sugar bounties. During this period, as the effect of these arbitrary additions to the polariscopic test of these domestic sugars was merely substantially to increase the amount of the bounty paid to their producers, it is not surprising that no one challenged the validity of the regulations which brought about so beneficent a result. In such an unlooked for and spontaneous increase by the Treasury Department itself of the "bounty" of Congress, every one else with unfeigned cheerfulness acquiesced.

These Internal Revenue Regulations of 1892, at all times ignored by the Customs Bureau of the Treasury Department, even during the period from 1892 to 1894; the Circuit Court of Appeals to the contrary notwithstanding.

The Circuit Court of Appeals based its opinion adverse to the importers in part upon the erroneous assumption that the Internal Revenue Regulations of 1892, increasing the amount of bounty paid on domestic sugars by these additions to the polariscopic test, had during the same period been recog-

nized by and in force in the Customs Bureau. Referring to "the book containing them" (to wit, pp. 175–226 of this Record), the Court says that this book

"also calls attention to proclamations of the President, March 15th, 1892, suspending from that date the provisions of the Tariff Act relating to the free introduction of sugar and declaring the duties set forth in section 3 (which provided for polariscopic tests) to be in force as to sugar the product of or exported from Colombia, Haiti and Venezuela. (Record, p. 180; foot note.) Manifestly these regulations applied not only to domestic sugars, but to such imported sugars as might come from those countries. * * * It seems a reasonable conclusion that Congress, when it passed the Act of 1897, containing merely the phrase 'testing by the polariscope,' without any further directions as to such test, without approval or condemnation of either of the variant methods of conducting it, which the Treasury Department had theretofore prescribed for imported as well as domestic sugars, intended to leave all details as to selection of instrument, employment of experts and instruction as to method to the sound discretion of the Secretary."

U. S. *v.* Bartram Bros., 131 Fed. Rep., 833, 836, 837.

But these regulations purport on their face to be merely "Regulations relative to the Bounty on Sugar of Domestic Production" (p. 175). The directions they embody are expressly stated to be applicable only to tests of sugar "under the provisions of law relative to bounty."

"The following directions for the use of the polariscope in testing sugar are based upon the recommendations in a report made to the Commissioner of Internal Revenue by a Commission consisting of the chemists of Internal Revenue, the chief chemists of the Department of Agriculture and the assistant in charge of Weights and Measures, Coast and Geodetic Survey. The prescribed course of procedure will be closely adhered to in all tests of sugar under the provisions of law *relative to bounty*" (p. 213).

Prefixed to these Internal Revenue Regulations, which commence at page 182, are printed for the information of the Internal Revenue officers excerpts from the Tariff Act of 1890, styled "Laws in regard to Sugar" (p. 177), including those sections imposing conditional duties on imported sugars as well as the bounty provisions with regard to domestic sugars. It is under this quotation of the provisions of the Tariff Act in regard to duties on imported sugar that the note in question occurs referring to the President's proclamation of March 15, 1892, imposing duties upon sugars from Colombia, Haiti and Venezuela.

Upon the face of this book it is, therefore, clear that there is absolutely nothing to justify the inference of the Circuit Court of Appeals that the Internal Revenue Regulations it contains were likewise regarded by or in force in the Customs Bureau. All possibility of inference or speculation upon the subject, however, is removed by the explicit testimony, not unnaturally overlooked by the Circuit Court of Appeals in this bulky record, of Mr. Edward Sherer. He, during the whole of this period and much longer, from 1880 down to 1898, was the Government chemist "specifically in charge of the polarization of sugar connected with the Appraisers' Office" (p. 54). He was, in fact, as the regulations themselves state (p. 158), the author of the Treasury Regulations of 1883, governing the polariscopic test, to which any so-called temperature corrections are unknown.

"The following instructions in regard to the use of the polariscope in the testing of sugar and molasses and the adjustment and care of the instrument, prepared and revised by Mr. Edward Sherer, Chemist in the United States Appraisers' Office at New York, are appended for the information of appraising officers."

Mr. Sherer's testimony upon the subject is explicit and absolutely uncontradicted:

"Q. Are you familiar with what is known as the standard or commercial method of testing sugar, used generally in the trade? A. Yes, sir.

Q. Was that method used by the Government in its laboratory? A. That was substantially the one adopted by the Government in 1880.

Q. *Used from that time continuously?* A. *Used continuously up to the recent regulations of 1897*" (p. 54).

The disappearance, with the repeal in 1894 of the bounties upon domestic sugars, and the substitution instead of duties upon imported sugars of any practice in the Treasury Department of making additions to the polariscopic test.

By the Act of Congress of 1894 the Act of October 1, 1890, was repealed, all sugar bounties abolished, and instead a duty of forty per cent. *ad valorem* levied upon all imported sugars. Under this act were promulgated the Treasury Regulations of May 13, 1895, "for the sampling and classification "of sugars and molasses under the provisions of the "Tariff Act of August 28, 1894, and for the polar-"ization of sugars as an aid in determining their "dutiable value" (p. 163). These regulations, so far as concerns the making of the polariscopic test, are in all essential respects identical with those prescribed by the regulations of 1883 followed by the trade chemists. Equally with them they ignore any necessity or excuse for any "correction" or "addition" to the observed polariscopic test. Under these regulations, undisturbed by the temporary aberration of the Internal Revenue

Bureau during the two previous years in undertaking to increase the polariscopic test by such additions, the Customs Bureau of the Treasury Department continued to adhere to the undoctored "polariscopic test" of sugars, "as an aid in determining their dutiable value," for three years until October, 1897.

The final rejection by the Treasury Department of "the polariscopic test" which Congress has prescribed as the basis of classification, and the adoption instead by the Department of another basis unknown to Congress, to wit, "the percentage of pure sucrose contained in the sugar" (p. 310).

In July, 1897, was passed the present Tariff Act abolishing the *ad valorem* duty of the act of 1894 and levying instead specific duties in accordance with the number of degrees "shown by the polariscopic test."

The framing of the necessary regulations was thereupon referred to a commission. Its personnel was the same, with an incongruous exception, as that of the commission which in 1892 had framed the regulations under the act of 1890. It has been seen that all the work of the former commission had been done by an "Engineer," Mr. Tittmann, to whose report Prof. Wiley and Dr. Crampton had gived a purely perfunctory concurrence; yet from the new commission Mr. Tittmann was the only one omitted. In his place was put his colleague, Dr. Braid, "Assistant in charge of Weights and Measures, U. S. Coast and Geodetic Survey" (pp. 83, 132). As Prof. Wiley and Dr. Crampton were thus already on record in the Department as having recommended

the regulations of 1892, which had prescribed a system of arbitrary additions to the observed polariscopic test of sugars, it was obviously inevitable that the new regulations should contain the same provision notwithstanding the embarrassment under which Prof. Wiley labored in having only in the previous January put himself on record in his book on Agricultural Analysis (pp. 100, 101) as of the opinion that "temperature had very little influence upon the results of polarization of sugars" (pp. 99, 100); "was negligible" (p. 101). Prof. Wiley, thus involuntarily enlisted as a champion of the theory that the polarizing power of sucrose varies inversely with its temperature, soon displayed all the proverbial zeal of a convert; and with this and his very great industry and ability, speedily became the protagonist in this country of his side of the controversy which has since waged over the validity of the theory, the history of which constitutes the bulk of this record.

In October, 1897, and again with some unimportant amendments in February, 1899, the new regulations in question here were promulgated. They require that the testing officer, having ascertained the polariscopic test of sugar, shall consult a certain table which is furnished by the Treasury Department (p. 174), entitled, "*table of* CORRECTIONS *to polarizations for changes in temperature from 4° to 40°* [*centigrade*] * * *

"ADD CORRECTIONS *when temperatures are above and subtract when below 17° C.*"

Having consulted this table, if the test has been made, as it always is, at a temperature above 17.5° C. (63.5° F.) the testing officer is required to make to the actual reading of the instrument the addition indicated by the table for the temperature at which the reading was taken; and to report as "the polariscopic test of the sugar," not the observed reading of the instrument, but this reading

increased by the arbitrary addition required by the table (Regulations, pp. 316, 335).

"The average figure [of the polariscope readings must be] corrected for the deviation shown by the control observation from the sugar value of the control plate at the temperature of observation as given in the table, and the result taken as the polarization of the sugar" (p. 316). (Table of Corrections, p. 174).

Reference to this table will show, for instance, that, if the testing officer had found the actual polariscopic test of a sugar to be, as shown by the reading of his instrument, 96° and the temperature of his room to be 80° F., or 27° C., the correction called for by the table of .3 requires the reported polariscopic test of the sugar to be, not 96°, but 96.3°; the importer, therefore, paying upon it a proportionately increased duty over what he would have had to pay if the actual reading of the instrument had been regarded.

Or, to quote *verbatim* from the Treasury Regulations (p. 313):

"For example: A sugar solution polarizes 80.5; the control plate just before had given a polarization of 91.4, the temperature of the room during both observations being 25° C. According to the table the value of the control plate at 25° C. is 91.7; the reading is therefore 0.3 too low, and 0.3 is added to the reading of the sugar solution, making the corrected result 80.8."

The struggle of Dr. Wiley and his associate experts to justify from a scientific standpoint the making of these arbitrary additions to the "polariscopic test," to ascertain the "percentage of pure sucrose con-

tained in the sugar"; and their final defeat at the meeting of the International Commission for uniform methods of sugar analysis, held in Paris, in July, 1900.

With the adoption of these regulations the Treasury Department was confronted with a difficulty which for obvious reasons had not troubled the Internal Revenue Bureau of the Department, when in 1892 they had adopted a similar system of making arbitrary additions to the polariscopic test of domestic sugars. At that time the only effect of the regulations had been to give to the producers of domestic sugars larger bounties than those provided for by the Act of 1890. Now for the first time the Department undertook to classify imported sugars, not in accordance with their polariscope test, as prescribed by the Act of Congress, but in accordance with the supposed "percentage of pure sucrose contained in the sugar" (p. 310), as ascertained by making to their polariscopic test an arbitrary addition averaging about .3° Ventzke; and to exact of the importers duties based upon this classification and correspondingly in excess of those which would have been payable had the sugars been classified simply according to their polariscopic test.

Issue was at once joined with the Department, both upon the legal question of its right thus under the guise of adopting regulations virtually to amend the statute, and to exact larger duties than those imposed by it; and upon the scientific question of the validity of the theory supposed to justify these regulations, that the polariscopic test obtained in practice in the Government laboratories is lower than that which would be obtained were the test taken at the temperature of 17.5° C. (63.5° F.). On behalf, both of the Government and of the importers, long series

of experiments with the polariscope were undertaken by many polariscopists of all degrees of experience and skill, all of them animated, it may be conceded, by no other conscious purpose than a desire to ascertain the truth; and none of them perhaps superior to the unconscious inclination of the expert to solve doubtful points in favor of the side upon which he is retained. Pamphlets and counter pamphlets were composed and published and the controversy finally culminated in an elaborate investigation and discussion of the subject at the third meeting of the International Commission for Uniform Methods of Sugar Analysis, held in Paris in July, 1900. This International Commission had been appointed in 1896 to study the international methods of analysis of sugar. It was composed of the most eminent sugar chemists of all sugar producing countries—notably, from Germany, Dr. Herzfeld of Berlin, the President of the Commission; Mr. Sachs, a delegate from Belgium; Mr. Strohmer, from Austro-Hungary; Mr. Winter of Java; Prof Brodhun of the Imperial Technical Institute of Charlottenburg; and from the United States, Prof. Wiley himself, and Dr. F. G. Wiechmann, the chief chemist of the American Sugar Refining Company (p. 417). At this meeting there was first read by Prof. Wiley an elaborate paper in defense of his theory that the rotary power of sucrose varies inversely with the temperature, and that where the test is taken at higher temperatures than 17.5° C., corresponding arbitrary additions to the reading are permissible and necessary to obtain the percentage of sucrose content. The other delegate from the United States, Dr. Wiechmann, the chief chemist of the American Sugar Refining Company, next read his paper (Printed at length in the Case, pp. 621–650). In this paper Dr. Wiechmann reviewed the existing literature on the subject and pointed out in the experiments relied upon to sustain Prof. Wiley's theory the sources of possible error which made his

deductions from them unsafe. Upon this branch of the case, his conclusion was expressed as follows:

" A critical survey of all the literature thus far examined has, therefore, failed to disclose a single indisputable demonstration of the correctness of the contention that temperature exercises an influence on the specific rotatory power of sucrose. On the other hand, evidence to the contrary exists in abundance. It appears in fact that a *majority* of the scientists who have carefully studied the question have reached the conclusion that the specific rotatory power of sucrose is a constant " (p. 641).

Dr. Wiechmann then gave in detail the results of a long series of most careful experiments carried on under his supervision (pp. 645–650), and stated his conclusion as follows (p. 650):

" All of the polarizations obtained under the stated conditions are virtually identical. These results, in perfect agreement with those previously given, clearly and undeniably lead to the conclusion that, *under the practical working conditions existing in technical sugar analysis, the specific rotatory power of sucrose is a constant.*"

A long discussion followed the reading of these two papers (pp. 418, 458). Thereupon the European chemists proposed the adoption of the following resolution (pp. 458, 616, 617):

" In general all sugar tests shall be made at 20° C. [to wit, 68° F., instead of 17.5° C., or 63.5° F.]. The adjustment of the saccharimeter shall be made at 20° C. One dissolves (for instruments arranged for the German normal weight) 26 g. pure sugar in a 100 metric cubic centimeters flask, weighing to be made in air, with brass weights; and polarizes the solution in a room the temperature of which is also 20° C. Under these conditions the instrument must indicate exactly 100.00. The temperature of all sugar solutions to be tested is always to be kept at 20° C., while they are being prepared and while they are being polarized."

Thereupon Prof. Wiley, Dr. Wiechmann and Dr. Winter, the delegate from Java, at once objected "that in our respective countries we could not all the year around work at the standard temperature of 20° C.

"Thereupon Prof. Herzfeld arose, as President of the Commission, and asked what suggestions we gentlemen might have to make with respect to that matter. Prof. Wiley thereupon offered the method which he had just discussed before the Commission [to wit, the making of arbitrary additions to the polariscopic reading] as the method to be adopted in such countries where 20° C. could not be admittedas the normal temperature" (pp. 458–459).

The original of the amendment which Prof. Wiley thereupon offered to the pending resolution was produced upon the trial by Dr. Wiechmann, who happened to have been the English secretary of the Commission. It reads as follows (p. 460):

"But in the countries where the deviation of the temperature from 20° C. is often very great it is necessary to graduate the polariscopes for the ordinary temperatures *or to make a proper correction to the readings of the polariscope.*"

What followed is best given in the words of the President of the Commission himself, Prof. Herzfeld, whose letter on the subject to Dr. Wiechmann is in evidence (p. 685):

"As chairman of the committee I myself after the debate, Wiley-Wiechmann-Brodhuhn, took occasion to declare that the committee could not decide scientific questions of dispute, nor could it vote as to who was right. As far as I am personally concerned, I consider the question not cleared. The majority of the members of the committee has *not* expressed any opinion regarding the influence of temperature on the specific rotation of sugar. * * * Just because the commission took my point of view

Wiley's proposition could not be accepted, and in the place of the same the resolution of Sachs was placed. Moreover, this was not an 'onprise,' because we had amongst ourselves agreed to this in prior discussion."

Thereupon at the suggestion of Prof. Sachs, Prof. Wiley withdrew his resolution and agreed to the adoption instead of the one proposed by Prof. Sachs. This resolution was unanimously adopted, both by Dr. Wiley and Dr. Wiechmann voting for it (Prof. Wiley's testimony, p. 423). The resolution of Prof. Sachs thus unanimously adopted in place of the one proposed by Prof. Wiley, which would have permitted the addition of "correction factors to the polariscopic reading," is given as follows in the official minutes of the meeting:

"However, for those countries, the temperature of which is generally higher, it is permissible that the saccharimeter be adjusted at 30° C. or at any other suitable temperature under the conditions specified above and providing the analysis of sugar be made at that same temperature" (p. 617).

In other words, the International Commission of Sugar Chemists, Prof. Wiley joining in the vote, refused to sanction the use of any additions or other alterations whatever to the observed polariscopic test, and recommended instead a course of procedure which would both avoid any tampering with the observed polariscopic test, and insure a correct result, whatever might be the truth with regard to the vexed question of the influence of temperature. This is, always to take as the polariscopic test the actual reading of the instrument; but to have the instrument itself graduated or standardized at the average temperature at which the tests are to be taken. This method eliminates the error which would result if it were true that a solution which at the standard tempera-

ture gave a certain polariscopic test would, at a higher temperature, give a lower one. It equally eliminates the error which would result from adding to the observed polariscopic test Prof. Wiley's or any other arbitrary "correction factors."

It has the double merit, in short, of complying literally with the Act of Congress, and yet obviating the supposed errors which are the excuse for the present illegal addition of "correction factors" to the standard of classification prescribed by that act. For these sufficient reasons it is that the adoption of this method was recommended by the Circuit Court in its opinion in these words:

"No reason is perceived why, if the Government desires to secure uniformity and accuracy, it should not take its tests or provide that they should be taken at the temperature at which its instruments are standardized" (Bartram Bros. *v.* U. S., 123 Fed. Rep., 327).

If reference to a public document published since the Circuit Court made this decision may be permitted, there will be found therein a further recommendation on this subject which the importers think the Court will find to be exactly in line with their contention, and interesting because transmitted by Professor Wiley himself for the approval of the Secretary of Agriculture. We refer to the Report (pp. 20, 21) of the Proceedings of the Twenty-second Annual Convention of the Association of Official Agricultural Chemists, edited by Professor Wiley as Secretary of the Association and published on his recommendation as Chief of the Bureau, in Bulletin No. 99 of the Bureau of Chemistry.

Errors Assigned.

The appellant's assignment of errors is to be found at pages 693-695 of the record.

We assume that in a case of this kind they are

largely formal and need not be here set forth at length.

The following specific assignments of error should perhaps be noted:

> "3. The Circuit Court erred in not holding that the addition to the number of degrees shown by the polariscopic test of said sugars of a certain percentage as a so-called correction for temperature, was and is in addition to the polariscopic test prescribed by the Act of Congress, known as the Tariff Act of July 24, 1897; and in not holding that such addition was and is, therefore, the imposition of an additional tax on said sugars by the Secretary of the Treasury in violation of the provisions of the statutes and Constitution of the United States.
>
> "4. The Circuit Court erred in not holding that the Act of Congress by the phrase 'testing by the polariscope' and 'polariscopic test' intended that the words should have the same meaning which had been attributed both by the trade and by the Treasury Department to the same words when used in the previous Tariff Act of March 3rd, 1883.
>
> "5. The Circuit Court erred in not holding that the Act of Congress in question by the phrase 'testing by the polariscope' and 'polariscopic test' intended the same polariscopic test which was then actually in force under the then existing regulations of the Treasury Department with reference to the ascertainment of duties upon imported sugars, and which had been in force under the regulations of the Treasury Department promulgated under the said prior Act of March 3rd, 1883, under date of May 22nd, 1883, in which prior act the same languages had been employed, and which was the only polariscopic test which was then or had ever been in use by the Treasury Department in classifying or determining the rate and amount of duties upon imported sugars; and which was and is the only polariscopic test known to the trade.
>
> "6. The Circuit Court erred in holding that

any increase of temperature occurring in actual practice reduces the rotary power of sugar solution in the polariscope, or otherwise produces a lower test than that which would be obtained at any lower temperature occurring in actual practice.

"7. The Circuit Court erred in holding that the assertion of some experts and the denial by others of the existence of any alleged influence of temperature upon the rotary power of sugar justifies the Secretary of the Treasury in requiring additions to be made to the observed polariscopic test of imported sugars prescribed by law, and so increasing the rate of duty payable upon them above that prescribed by law.

"8. The Circuit Court erred in holding that the polariscopic test means 'the percentage of pure sucrose contained in sugar as ascertained by polarimetric estimation.'

"9. The Circuit Court erred in holding that under the existing regulations of the Treasury Department 'the percentage of pure sucrose contained in sugar' is ascertained, either absolutely, or more approximately than by the polariscopic test itself.

"10. The Circuit Court erred in holding that under the existing regulations of the Treasury Department, 'the percentage of pure sucrose contained in sugar' or anything else, is 'ascertained by polarimetric estimation'; and in not holding that under such regulations whatever is ascertained is ascertained only in part by polarimetric estimation and in part by an arithmetrical process of an addition to the tests shown by the polariscope of a self-styled 'correction.'

"11. The Circuit Court erred in holding that the regulations promulgated by the Secretary of the Treasury under date of October 27th, 1897, or the revised regulations promulgated by him under date of February 17th, 1899, in conformity with which such sugars were tested, are reasonable regulations, or are authorized by the laws or Constitution of the United States."

First Point.

The appeal in this case although arising under the Revenue Laws is properly brought direct from the Circuit Court and brings with it not only the constitutional question involved, but all the questions arising upon the record.

If the Treasury regulations are invalid, it is because in assuming to add something to the dutiable standard prescribed by the Tariff Act they constitute an exercise by the executive branch of the Government of legislative power which, by the Constitution, has been confided solely to Congress. In a case presenting this question, a direct appeal lies to this Court.

Boske v. *Comingore*, *177 U. S., 459:*

Appeal from the final order of a District Court involving the validity of certain Treasury regulations with regard to the custody of records in the office of the Collector of Internal Revenue:

Held: "That the case was properly brought directly from the District Court to this court as one involving the construction or application of the Constitution of the United States."

Such an appeal brings up every question in the case.

Davis Co. v. *Los Angeles*, *189 U. S., 207.*

Horner v. *United States*, *No. 2, 143 U. S., 570.*

Chappell v. *United States*, *160 U. S., 499.*

Where this constitutional question is presented, it is immaterial that the case arises under the Revenue Laws.

Spreckels Sugar Refining Company v. *McClain, 192 U. S., 397:*

By the Court: "As then the case made by the plaintiff involved a question other than those relating to the constitutionality of the act and to the application and construction of the Constitution, the Circuit Court of Appeals had jurisdiction to review the judgment of the Circuit Court, *although, if the plaintiff had elected to bring it here directly, this Court would have had jurisdiction to determine all the questions arising upon the record* * * * . The meaning of the words 'arising under the Revenue Laws,' in the sixth section, is satisfied if they are held as embracing a case strictly arising under laws providing for internal revenues and which does not, by reason of any question in it, belong also to the class mentioned in the fifth section of that act (of 1891). We do not think that the words quoted necessarily embrace a case carried to the Circuit Court of Appeals, which, although arising under the Revenue Laws and involving a construction of those laws, depends for a full determination of the rights of the parties upon the construction or application of the Constitution or upon the constitutionality of an Act of Congress."

Second Point.

Whereas Congress has prescribed that sugars shall be classified for dutiable purposes according to "the polariscopic test," the sugars in question here have been classified, not in accordance with the polariscopic test, but in accordance with the polariscopic test increased by an arbitrary addition of about .3 degrees V., and duties upon them exacted of the importers correspondingly in excess of those which could have been assessed if the "polariscopic test" alone had been regarded in the classification of them.

The question thus presented is in all respects the same as that which was before this Court under the

sugar schedule in force in 1879, classifying sugars according to the "Dutch standard in color"; but with the important difference in favor of the importers that there was in that case a deliberate attempt to evade the tariff (*i. e.*, "by giving to sugars in the process of manufacture a low grade of color"), no suspicion of which is or could be imputed to the importers here.

Then, as now, the Treasury Department was unwilling to obey the law which prescribed what the Department considered an adequate standard of classification; and then, as now, by Treasury Regulations it endeavored to substitute another standard believed to indicate more closely the saccharine strength of the sugars. But this Court compelled the Treasury Department to follow the law, rather than the views of the Department as to what the law ought to be.

Merritt *v.* Welsh, 104 U. S., 694:

"By the Court: It will be perceived that the real question in the case is, whether (supposing that sugars are not artificially colored for the purpose of avoiding duties after being manufactured) their dutiable quality is to be decided by their actual color, graded by the Dutch standard, or by their saccharine strength as ascertained by chemical tests. The plaintiffs maintain the former proposition; the defendant, the latter.

"The test described by the statute is, 'Dutch standard in color.' The first question that naturally arises is, if Congress desires the application of the chemical test, in order to determine the saccharine strength of the sugar, why does not Congress say so? There are two very distinct and different modes of distingushing sugar—by its color, and by the intrinsic percentage of specific crystalline sugar in the mass. One is determined by a color standard, the other by a chemical standard. Which of these did Congress adopt? We think, clearly, the former.

"Perhaps Congress may have acted under a mistaken idea that color would always indicate quality. Perhaps, up the time that the law

was passed, as the processes of manufacture had been conducted, color was an approximate, or general, indication of quality. Suppose this to be so, does it derogate from the fact that color was the standard which Congress, with the lights which it had, saw fit to adopt? Does it not tend to fortify that fact? If it be found by experience that the standard is a fallacious one, can the executive department supply the defects of legislation? Congress alone has the authority to levy duties. Its will alone is to be sought.

* * * * * *

"The perfection of the refining process as now practiced renders color in raw sugars a matter of little consequence, provided they contain abundance of saccharine matter. The color standard has come to be a precarious one. Still, if the Government chooses to adhere to it, it is bound by it. If Congress, as it has done, adopt the color standard, it is not for the Customs Department to adopt a different one. When Congress choses to do this, it will be time enough for the Government to follow. As before said, Congress alone has the power to lay taxes and duties.

"* * * If in the case under consideration a color standard is insufficient, a different one is ready to hand—that of the polariscope or other chemical test. *If the quantity of saccharine matter in sugar, or its state of advancement from the raw state to a condition of refinement, is desirable as a dutiable standard, let it be so declared by the laws.* * * *

"* * * In making its election, Congress did not leave any room for doubt as to its meaning. It used apt terms to express it, terms free from all ambiguity and obscurity. If the test adopted fails to effect the desired object, the inconvenience or loss to the Treasury need only be temporary. It can be changed at any moment. And it is better to submit to a temporary inconvenience than to set the laws all afloat by laying down a canon of construction which leaves the plain words and seeks to spell out or guess at the supposed intent of the Legislature contrary or supplementary to that which is clearly embodied in the words it has used."

This language of this Court applies as aptly to the facts in the case at bar as to those then before the Court. In that case the effort of the Treasury De-

partment was identically the same as in this,—to disregard the standard of classification of imported sugars prescribed by Congress, and instead by Treasury Regulations to impose upon the citizen a different standard which the Department itself considers a better one.

And it is no less true now than then that Congress, which after all still remains the Legislative Branch of the Government, has seen fit *not* to impose duties upon the different grades of sugar in accordance with the percentage of pure sucrose contained in them. It might have done so, but did not; doubtless, for the reason that there is no practicable trade method of ascertaining this sucrose content. What Congress did was to classify sugars into different grades, according to the "polariscopic test," and to impose different rates of duties upon these different grades. The attempt of the present Treasury Regulations to discredit the polariscopic test as inaccurate unless increased by Dr. Wiley's "correction-factors," necessarily proceeds upon the assumption that when Congress directed that sugar should be graded according to "the polariscopic test," it really intended that they should be graded according to something else, viz., the percentage of pure sucrose contained in them. The Treasury Regulations themselves explicitly admit the making of this assumption:

"79. The expression 'testing * * * degrees by the polariscope,' occurring in the Act, is *construed* to mean the percentage of pure sucrose contained in the sugar as ascertained by polarimetric estimation" (p. 310).

Such a "construction" of tariff laws defies all the canons of interpretation applicable to them. The language actually employed by Congress, if it has a sensible meaning, is to be given that meaning. Language which it might have employed, cannot be substituted by construction for the language which it did employ.

Morrill v. *Jones, 106 U. S., 466:*

The Revised Statutes provides that "animals alive specially imported for breeding purposes from beyond the seas shall be admitted free of duty upon proof thereof satisfactory to the Secretary of the Treasury and under such regulations as he may prescribe."

Under this act, Treasury regulations were promulgated providing, among other things, that before the Collector admit such animals free, he must, among other things, "be satisfied that the animals are of superior stock, adapted to improving the breed in the United States."

By the Court: "The Secretary of the Treasury cannot by his regulations alter or amend a revenue law. All he can do is to regulate the mode of proceeding to carry into effect what Congress has enacted. In the present case we are entirely satisfied the regulation acted upon by the Collector was in excess of the power of the Secretary. The statute clearly includs animals of all classes. The regulation seeks to confine its operation to animals of 'superior stock.' This is manifestly an attempt to put into the body of the statute a limitation which Congress did not think it necessary to prescribe. Congress was willing to admit duty free all animals specially imported for breeding purposes; the Secretary thought this privilege should be confined to such animals as were adapted to the improvement of breeds in the United States. In our opinion, the object of the Secretary could only be accomplished by an amendment of the law. That is not the office of a treasury regulation."

United States v. *Eaton, 144 U. S., 677:*

The Act of Congress imposed a penalty upon the dealers in oleomargerine who failed to make monthly returns to the Collector of Internal Revenue, showing his receipts and sale. The Treasury Department promulgated, under this Act, a regulation requiring all such dealers to keep a book showing his receipts and sales.

HELD: "That the regulations did not have the force of law so as to justify the prosecution against

a dealer for the penalty imposed by the Act for violations of the Act itself."

By the Court: It was said by this Court in *Morrill* v. *Jones, 106 U. S., 466*, that the Secretary of the Treasury cannot, by his regulations alter or amend a Revenue Law and that all he can do is to regulate the mode of proceeding to carry into effect what Congress has enacted.

United States v. *Simmonds, 120 U. S., 46:*

"Does the statute confer upon the Secretary of the Navy, acting alone, or by the direction of the President, the power to declare a particular service to be shore service; if not that, it was performed by the officers when at sea, under the orders of the Department and on a vessel employed by the authority of law. * * * Congress certainly did not intend to confer authority upon the Secretary of the Navy to diminish an officer's compensation as established by law by declaring that to be shore service which was in fact sea service, or to increase his compensation by declaring that to be sea service which was in fact shore service. The authority of the Secretary to issue orders, regulations and instructions, with the approval of the President, in reference to matters connected with the naval establishment, is subject to the condition necessarily implied that they must be consistent with the statutes which have been enacted by Congress in reference to the navy."

Third Point.

When Congress enacted that the standard of sugar classification should be "*The* polariscopic test," its use of the definite article demonstrates that it referred to a definite thing. In the face of this language of the Legislature, the Executive and Judicial Departments have only to inquire to what definite "polariscopic test" Congress did refer, as the standard intended, and having ascertained it, enforce it.

In any such inquiry, the first step must necessar-

ily be to eliminate from consideration any standard made up in part of a polariscopic test, and in part of something else, whether styled "arbitrary additions," "temperature correction factors," or anything else. The one is expressed in the statute. The other is not expressed; and is therefore excluded.

Fourth Point.

To this inquiry as to what was the definite "polariscopic test" to which Congress referred, the evidence gives an immediate, unqualified, and unanimous reply. If the Committee on Ways and Means, before recommending the proposed duty of 95/100 of one cent per pound on sugars "testing by the polariscope not above 75 degrees," had sought information as to what was intended by this phrase "testing by the polariscope," it would have applied to one or both of two sources and received the same answer from each. From the officials of the Treasury Department in charge of the execution of the tariff laws theretofore in force on imports of sugars the committee would have ascertained that all imported sugars were then being daily, and had been daily since 1883, except while on the free list from 1890 to 1894, "tested by the polariscope" by all the sugar examiners in the service under a method prescribed in detail by the Treasury Regulations of 1883 and 1895; and that not a sample of imported sugar had ever been tested by the Treasury Department under the polariscope by any other method. The Treasury officials would furthermore have pointed out that this same phrase "testing by the polariscope" had been employed in the Tariff Act of 1883 and its meaning construed by the Treasury Regulations of that year, and that if the same language were again employed in a later statute, it would necessarily be given the same meaning. If

the committee had then turned for information to the different trade chemists in the country upon whose polariscopic tests all imported sugars were then being, and had been for twenty years, bought and sold, and inquired of them the meaning of the phrase "testing by the polariscope," it would have received from each of them the same answer, to wit, that they practiced and knew of but one method, viz., that described at length in the Treasury Regulations of 1883.

The absolute unanimity of the evidence on this point has already been referred to. The evidence is conveniently summarized in "Appendix A," annexed to this brief.

Fifth Point.

To allow the Treasury Department to make to the polariscopic test of all imported sugars an addition averaging .3 V would be to derange the whole system of classification of sugars, devised by Congress with minute care and presumably an intelligent purpose--even to the point of making dutiable under one rate of duties a possibly large and important class of sugars which Congress for reasons of its own had made dutiable under a very different one.

It is not open to doubt that if Congress or its committee, in considering the Tariff Bill of 1897, had sent to the Customs Department of the Treasury for a sample of the sugar described in the bill as "sugars * * * testing by the polariscope not above 75°" as that upon which the lowest duty of 95/100 of one per cent. per pound should be imposed, the customs officials would have produced a sugar which they and all trade chemists would then have classified as "testing by the polariscope" 75°. It was this particular grade of sugar which Congress

then determined to and did enact should pay a duty of 95/100 of a cent per pound, and no more.

Yet if this same sample of sugar had, three months later after the promulgation of the Regulations of October, 1897, been taken back to the Treasury Department it would then have been classified as testing 75.3°, and every pound of it required to pay an additional duty over the 95/100 of a cent, of .0105 cents.

It is to prevent the possibility of such proceedings as these that the rule of law has long been laid down in the courts as follows:

U. S. *vs.* Chemical Company, 79 Fed. Rep., 313 (313):

By the Court: "When the words used in the tariff act have some peculiar trade meaning, it must, of course, be assumed that Congress used them with the meaning they had when they were inserted in the act; *not with some new meaning acquired afterwards.*"

Cadwallader *vs.* Zeh, 151 U. S., 171:

HEAD NOTE: "If words used in a statute imposing duties on imports had *at the time of its passage* a well-known signification in our trade and commerce differing from their ordinary meaning among the people, the commercial meaning must prevail, unless Congress has clearly manifested a contrary intention."

Elliott *vs.* Swartwout, 10 Pet., 137:

"Laws imposing duties on importations of goods are intended for practical use and application by men engaged in commerce, and hence it has become a settled rule in the interpretation of statutes of this description to construe the language adopted by the Legislature, and *particularly* in the denomination of articles according to the commercial understanding of the terms used. * * * Any instructions from the Treasury Department could not change the law nor affect the rights of the plaintiff."

In the case at bar the language in question is, according to the expression of the Supreme Court in the case last cited, "language adopted by the Legislature" * * * in the denomination of articles. The phrase in question, "testing by the polariscope," is used in the statute as an adjective phrase modifying the word "sugars." The adjective is as much a part of the "denomination" of the article as the noun.

But were this phrase not thus employed the rule would apply to it with equal force. It is according to the Supreme Court only "particularly" in the denomination of articles that the rule operates. The precise proposition that it equally applies to a reference in the statute to a required "test" for the purpose of determining classification or dutiable value, has recently, since the decision of the Board of Appraisers in this case, been squarely affirmed by the Circuit Court of the United States in an analogous case, and adopted by the Treasury Department itself in Department Instructions, dated September 16, 1899 (S. 21,602).

In re Puget Sound Reduction Co., 96 Fed. Rep., 90:

HEAD NOTE: "It being shown by uncontradicted testimony that what is known as the 'fire process,' which gives the quantity of lead in an ore that can be saved by smelting, is exclusively used in making assays for commercial purposes and is known as the 'commercial method,' instructions issued by the Treasury Department adopting for customs purposes what is known as the 'wet process' of assaying, which shows the actual quantity of lead in an ore, making no allowance for loss in smelting, *require the payment of a higher duty than is contemplated by the Tariff Act* and *are in contravention of the positive requirement of the act of 1895.*

The Act of 1895 referred to had prescribed that the method of sampling and assaying such ores to be employed by the department "shall be the same as that usually adopted for commercial purposes by public sampling works in the United States."

There was a question whether or not this act had been repealed by the Dingley law of 1897, which the Court decided adversely to the Government. But the decision was not put upon this ground alone. The language of the Court was, in part, as follows:

"Such a construction for the purpose of making the burden upon commerce heavier would be contrary to the rule sanctioned by the Supreme Court of the United States in the case of Hartranft *v.* Wiegmann, 121 U. S., 609, 7 Sup. Ct., 1240, in the following words: 'Duties are never imposed on the citizen upon vague or doubtful interpretations.' In other decisions of the Supreme Court it has been held that in construing tariff laws 'the terms used, being addressed to merchants, are to be understood in their mercantile sense, the ascertainment of which is matter of fact, depending upon evidence' (Stuart *v.* Maxwell, 16 How., 150–163; Two hundred Chests of Tea, 9 Wheat., 430–438; U. S. *v.* One hundred and Twelve Casks of Sugar, 8 Pet., 277; Elliott *v.* Swartwout, 10 Pet., 151; Arthur *v.* Morrison, 96 U. S., 108)."

The instructions of the Treasury Department upon this decision were as follows:

"This case involved the question whether, under the provisions of paragraph 181 of the act of July, 24, 1897, which directs that samples of imported lead ore shall be submitted to the Government assayer designated by the Secretary of the Treasury, who shall make an assay of the samples under such regulations as the Secretary may direct, it was competent for the Secretary of the Treasury to prescribe that samples so assayed should be assayed by what is scientifically known as the 'wet' process. On the part of the importers it was claimed that in commerce it was the usual and well-established practice to assay lead ores by the dry method or fire assay, and that, therefore, such method should be applied to the assaying of imported lead ore for dutiable purposes under paragraph 181 of the act of July 24, 1897.

"On the trial of the case the Court found that it was the recognized usage of trade to assay lead ore by the dry method or fire assay, and that it was, therefore, reasonable to presume that Congress had

this method in view. The Court, therefore, overruled the decision of the Board of General Appraisers, which had affirmed your classification and assessment of duty on the basis of the 'wet' assay.

"In view of the evidence in the case showing well-established commercial usage, the Attorney General advises this Department that no further proceedings will be directed. * * *

"Respectfully,

"O. L. SPALDING,

"Assistant Secretary."

Sixth Point.

Finally, conceding for the moment that the Treasury Department may by its regulations repeal the Act of Congress which makes the "polariscope test" the standard of classification, and may enact instead that it shall be the "percentage of sucrose content," it certainly has not the power to direct that the polariscopic test plus an arbitrary addition of .3° V. be taken to give the "sucrose content" when such an addition, in the case of refined sugars, gives instead of the true sucrose content a supposed sucrose content, which, in the language of the Circuit Court, is a "chemical impossibility"; and, in the case of raw sugars, according to Dr. Wiley's Bulletin, No. 99, of the Bureau of Chemistry, "accomplishes only the untoward result that the error of reading was increased instead of diminished."

The scale of the polariscope is so adjusted that it will indicate 100 only when the solution of sugar being tested is chemically pure. Such is the fact, and such is the assertion of the Treasury Regulations themselves:

"The 'Ventzke scale' is hereby defined to be such that *one degree* of the scale is the 1/100 part of the rotation produced in the plane of polarization of white light in a column 200 millimeters long by standard solution of chemically pure sucrose at 17.5 degrees C." (p. 213).

Nothing, therefore, less pure than "chemically pure sucrose" ought to test 100 degrees under the polariscope. "Chemically pure sucrose," however, is unknown to commerce. Chemists, in fact, obtain it with the greatest difficulty, and keep small quantities of it in glass-stoppered bottles.

Vide the resolution of the International Sugar Commission of July, 1900 (p. 616):

"The chemically pure sugar which is to be employed for this purpose shall everywhere be prepared according to the same method, which is as follows (method of the English chemists):

"Purest commercial sugar is to be further purified in the following manner: A hot saturated aqueous solution is prepared and the sugar precipitated with absolute ethyl alcohol; the sugar is carefully spun in a small centrifugal machine and washed in the latter with some alcohol. The sugar thus obtained is redissolved in water, again the saturated solution is precipitated with alcohol and washed as above. The product of the second centrifugating is dried between blotting paper and preserved in glass vessels for use."

The purest refined sugar of commerce may test, at the most, 99.80 degrees V.; very rarely 99.91 (pp. 54, 55). It will be remembered, for instance, that the "sample of purified sugar," upon which Dr. Austin experimented, and which he said he had obtained from Professor Wiley, "purporting to have been made by the American Sugar Refining Company, a very beautiful specimen of sugar, and in every way appeared to be a pure sample" (pp. 360–362), tested at 25.5 C. only 99.80, and therefore at 17.5 C., 99.93.

Professor Harvey W. Wiley:

"A pure sugar, accurately measured and correctly polarized, could not polarize over 100 degrees. I may add that an observer may polarize a given solution 100.2, which would have been polarized under normal conditions at exactly 100 by another observer" (pp. 98, 99).

Charles A. Crampton:

"It is not possible for an absolute polarization of sugar to go over 100 degrees; the absolute true polarization; the absolute content of sugar" (p. 118).

Edward Sherer:

"Q. Does the refined sugar of commerce ever test 100? A. No, sir.

"Q. What sugar is supposed to test 100 on these instruments? A. Chemically pure sugar, prepared by chemical processes and purified.

"Q. Is the refined sugar that is found in the trade chemically pure? A. I should consider it impossible that it should be.

"Q. Then that sugar could never test 100 on a correct instrument? A. I think not." * * * (p. 450).

W. E. DICKSON, U. S. Sugar Examiner:

"Q. What is the ordinary test of granulated sugar that comes under your observation? A. Somewheres around 99.8 or 9.

"BY MR. GIBSON:

"Q. Do you know whether there is any such thing as absolute pure sugar in science? A. Pretty hard thing to get.

"Q. Would not absolutely pure sugar be purer than what is known as chemically pure sugar? * * * A. I have heard of sugar being called chemically pure sugar. I don't know as I ever saw a sample of it.

"Q. Chemically pure sugar is not absolutely pure? Is that your answer? A. Pretty hard to get a thing absolutely pure. It ought to test just 100" (p. 73).

Now, if the importers are right in their contention that the present Treasury regulations result in the sugar being officially tested at .3 degrees higher than it ought to be, it would follow that the higher grades of granulated sugars, heretobefore testing 99.8 or 99.9, will, under the present Government test, test at 100 degrees, and more than 100 degrees, absurd as this may be. On the other hand, if the

Government method is right, and does not, as claimed by the importers, result in an excessive test, the reported Government tests of the imports of refined sugars will show them testing on the average certainly not above 99.8.

What are the facts?

(*a.*) Since the present Treasury Regulations went into effect, of all the refined sugars brought to this port and tested at the United State's Appraiser's stores by the Government officials, not less than 30 per cent. test over 100 degrees—*i. e.*, they are something more than chemically pure.

Ernest W. Chapman, Government polariscopist:

"Q. Since the Regulations of October 27, 1897, went into effect, what results have you found in respect to the testing of refined sugars? A. We found that the tests run 99.7 to 100.2 or three tenths.

"Q. How many cases have you found in testing foreign sugars where the tests run over 100? A. About 30 per cent. 100 or over.

"Q. Does the record show that they tested over 100? A. No, sir.

"Q. What does the record show? A. 100.

"Q. Why do you put on the record that the test was 100? A. I didn't think it would look well to report them.

"Q. What is your experience with regard to testing the same character of sugars under the previous regulations? A. Seldom we had a sugar tested over 100.

"Q. Did you ever have any that tested over 100? A. Not that I recall.

"Q. What was the highest average? A. About 99.8 possibly" (pp. 70-71).

R. W. Moore, chemist, in charge of the laboratory at the United States Appraiser's office:

"They [tests under the new regulations] have always been reported at from 99.7 to 100, the results as approved and forwarded by me. * * * Some of

the observers have claimed that they have read higher to the extent of a tenth or so, but as it was manifestly impossible, the sugar was not reported as over 100 per cent. * * * I do not know what the maximum would be. * * * In very many samples they found a higher test—run over they told me" (pp. 63–64).

Edward Sherer, from 1880 to 1898 United States Officer in charge of the polarization of sugar:

"Q. Did you have occasion while you were in the laboratory—under the new regulations—to make polariscopic tests of any samples of refined sugar? A. Yes, sir. * * *

"Q. Did you make those tests strictly in accordance with the regulations? A. I did.

"Q. What was the actual result yielded by those tests of refined sugar? A. In many cases the polarizations obtained by the Government method were somewhat over 100 per cent.; in very few cases was it under 100. It was as a rule very close to 100.

"Q. What is the ordinary test of foreign refined sugars? A. The test of foreign refined sugars, such as we received in the laboratory prior to the use of the existing regulations, was about 99.8 per cent. We sometimes got a sugar 99.9, but rarely.

"Q. What were the tests under the new regulations? A. Almost never under 100; sometimes more.

"Q. When you spoke of 99.8, did you mean that was the maximum or minimum or average? A. I should not call it an average. I should say the average would be 99.7; the maximum would be 99.9, I should say.

"Q. How high did you ever find refined sugar to test under the new regulations? A. 100.4.

"Q. Were those tests recorded? A. The test reported was invariably 'as over 100 per cent.' When there was a higher reading, the sugar was found as 100.

"Q. Why was that? A. It being manifestly absurd to report sugar as being over 100 per cent., it was not done" (pp. 54–55).

(*b.*) The elaborate precautions prescribed by the resolution above quoted of the International Con-

mission of Sugar Chemists for obtaining chemically pure sugar which shall test under the polariscope 100 degrees are no longer necessary. At the Port of New York the "purest commercial sugar" is incapable of "being further purified in the following manner." The official record "Importations of Refined Sugar" (pp. 667-678), shows that in New York chemically pure sugar is imported every month by the shipload.

Date.	No. of Packages.	Appraised Value.
Jan. 4, 1900	60	100 00
" " "	1,000	100 00
Feb. 7, "	460	100 00
Mar. 2, "	300	100 00
April 28, "	460	100 00
" " "	1,000	100 00
July 13, "	2,000	100 00
June 29, "	1,000	100 00
July 17, "	3,000	100 00
" " "	2,000	100 00
" " "	1,661	100 00
" " "	500	100 00
" 27, "	2,500	100 00
Aug. 3, "	3,000	100 00
" 9, "	1,000	100 00
" 11, "	2,788	100 00
" " "	750	100 00
" " "	1,305	100 00
" " "	848	100 00
" " "	8,500	100 00
" " "	1,859	100 00
" 17, "	465	100 00
" 21, "	1,040	100 00
" 28, "	2,000	100 00
" 30, "	1,000	100 00
" " "	1,000	100 00
" " "	580	100 00
" " "	1,857	100 00

Date.	No. of Packages.	Appraised Value.
Sept. 1, 1900	2,221	100 00
" " "	1,293	100 00
" 8, "	2,100	100 00
" " "	400	100 00
" 11, "	2,240	100 00
" 14, "	3,300	100 00
" 22, "	432	100 00
" " "	117	100 00
" 26, "	2,000	100 00
" " "	1,700	100 00
" " "	500	100 00
" " "	1,000	100 00
" " "	1,000	100 00
Oct. 3, "	500	100 00
" " "	1,250	100 00
" " "	1,250	100 00
Nov. 17, "	550	100 00
Dec. 13, "	1,500	100 00
" " "	3,000	100 00
" " "	3,000	100 00
" 21, "	650	100 00
" " "	500	100 00
" " "	500	100 00
" 28, "	2,916	100 00
Jan. 16, 1901	250	100 00
" " "	3,000	100 00
" " "	13,875	100 00
" 23, "	496	100 00

6. Dr. Wiechmann:

"Following the Government method strictly and conscientiously in every detail, I have, in polarizing sugar that had a value of 99.98 by the universally accepted commercial method, never found it to polarize less than 100.20. To be exact in that instance, never less than 100.275. The average of about ten or twelve tests have been about 100.3125. * * * The Government method thus assigns to a sugar a value of fully 0.3 over and above 100 per cent." (p. 31).

John A. Sherer:

"The experiments made by us (in the witness' laboratory) showed an average difference of .4 of a degree on pure refined sugar, a sample of which we received from Dr. Wiechmann, the true polarization of which was 99.98. We found the difference to be on the average .4 of a degree above the commercial method.

"Q. How much above 100? A. The average above 100 was .276, practically .3 of the average of a number of tests" (p. 39).

Edward Wolfbauer:

"Q. Did you make some experiments with chemically pure sugar—some tests by both methods? A. Yes, by both methods.

"Q. What was the result of those tests? A. The result was that the polariscopic readings of the commercial methods and the Government method there was a difference, the Government method being between three and four tenths higher.

"Q. Did you find that this chemically pure sugar was about 100? A. The chemically pure sugar tested by scientific tests—and it was 99.98— * * * The test found was 100.3, about. It might have been a few one-hundreths more. * * *

"Q. What was the minimum? A. The minimum was 100.2.

"Q. The maximum? A. About 100.4" (pp. 51-52).

Dr. Weichmann:

"To test the system of correction factors strictly on its merits a number of tests were made with practically pure sucrose (Polarization 99.98). Thus any and all undue concentration of the solution examined was avoided, as no clarifying re-agent was needed in preparing them for observation in the saccharimeter. This work was carried on by several observers, the writer among the number. * * * The data are given in the following table:

Test No.	Reading observed	Temperature, degrees Centigrade at which solution was prepared and the reading taken.	Wiley's "Correction-factor" derived from his table. To be added to the readings found.	"Corrected" Polarization according to Professor Wiley's data.
1	99.90	23.0°	0.18	100.08
2	99.85	24.5°	0.22	100.07
3	99.90	25 0°	0.24	100.14
4	99.90	25.7°	0.26	100.16
5	99.90	26.5°	0.28	100.18
6	99.90	27.5°	0.32	100.22
7	99.90	29.0°	0.37	100.27
8	99.85	30.0°	0.40	100.25
9	99.80	31.7°	0.45	100.25
10	99.80	33.0°	0.50	100.30

"From this record it clearly appears that the use of Professor Wiley's so-called 'correction-factors' would ascribe to pure sucrose—at the temperature at which the experiments were made—a polarization of over 100 per cent. The excess over and above 100 per cent. will be seen to keep pace with the rise of the thermometer; further comment is unnecessary" (p. 639).

5. Of course, Treasury Regulations which when applied to the refined sugar of commerce produce results like these, cannot stand in a court of justice, unless such results can be completely explained away. But two attempts at explanation have been made by the Government. Neither of them has any foundation in fact, and neither of them explains.

(1.) The suggestion is made, rather helplessly, that the "permitted error of observation" or "factor of inaccuracy" of .2 may account for this unpleasant phenomenon of commercial refined sugars testing constantly at the United States Laboratory 100.2 to

100.4 degrees, and of these results being modestly suppressed because the examiner does not "think it would look well to report them." It has, however, been testified by several Government experts that, as a result of the greater accuracy in other respects of the new regulations, and especially of the standardizing of the instruments, errors of observation have in fact been eliminated up to the point of .1°, so that all the tests of the different laboratories in the country of a particular sample will agree within .1° V.

DR. WILEY:

"At the present time the agreement [between the laboratories of Boston, New York and Philadelphia] is extremely exact [the difference], rarely amounting to more than .1 of a degree" (p. 92).

C. A. Crampton:

"For the month of October, on 46 samples which were polarized at three different ports [the tests] varied from each other not more than 1/10 of one per cent. on the grand average" (p. 116).

Andrew Braid:

"The agreement between exchange samples of the different ports has been testified to by others, and it has been very satisfactory. The agreement, I believe, is within one-tenth of a degree" (p. 138).

The "permitted error of observation" might, therefore, occasionally account for the granulated sugar of commerce, which ought to test 99.8 (fol. 405), testing 99.9. But before tests of it at 100.2, 100.3 and 100.4, it is speechless.

(2.) The second attempted explanation is, that there may be present in these refined sugars "raffinose," a form of sugar which, when present in sucrose, may have the effect of causing it to test more than 100 degrees.

There is at least a three-fold difficulty with this explanation.

(*a.*) The explanation is a pure assumption. There is no evidence whatever that in any one of the samples tested in the course of this trial or in any one of the cargoes which have been appraised at 100 there was in fact an atom of raffinose.

(*b.*) There is precisely as much reason for suspecting the presence of raffinose in the sugars upon which were made the various tests which were made by the Government experts (the various tests upon which is based the justification of the present Treasury Regulations) as there is in suspecting its presence in the sugars tested by the experts for the importers, and in all the numerous cargoes of chemically pure sugars which, according to the Government records, have of late been brought into this port. If the possible presence of raffinose in these imported sugars and in the sugars employed by the experts of the importers in their tests in this case vitiates these tests and the conclusion sought to be drawn from them, it equally vitiates the Government tests and the conclusions to be drawn from them. "It is a poor rule which does not work both ways."

(*c.*) The explanation does not explain. The fact remains unaccounted for that cargo after cargo of sugar brought into this port has been appraised, under the present Government methods as testing 100° by the polariscope—to wit, as chemically pure. To say, as the Government would say, that of course it was not chemically pure, but that its apparent test as chemically pure, was caused not by any error of the regulations, but by the presence of raffinose, does not affect the fact that but for the arbitrary addition required by the regulations to the observed polariscopic test, the sugar would not have been falsely appraised as chemically pure. It is an

admission that this addition to the actual test was in the case of each of these cargoes erroneous and unjustifiable.

6. Until some better explanation than any so far advanced is provided for the astounding fact that under the administration of the present Treasury Regulations almost every other cargo of refined sugar imported into this port consists of sugar either absolutely chemically pure or more than absolutely chemically pure, it should be impossible that regulations which accomplish such absurd results can be sustained in a court of law.

And as concerns raw cane sugars, we now find in the official publication of the Government, Bulletin No. 99, *supra*, before referred to, edited and "transmitted for approval" by Dr. Wiley himself; the conclusions already quoted:

"That while the Table (of correction factors) may be valuable in polarizing refined sugars, it will not answer in polarization of raw cane products. * * * That with low-grade sugars it is far better to do without the table of sucrose corrections, as in each of the above cases where such correction was made, the error of reading was increased instead of diminished."

Last Point.

The language of the act imposing a duty upon "sugars * * * testing by the polariscope" above 75 degrees, "for every additional degree shown by the polariscope test" so much per degree, expresses three commands, each of which is violated by the Treasury Regulations in question:

1. It is required that the number of degrees at which the imported sugars shall be classified for dutiable purposes shall be the number of degrees at which these identical sugars "test by the polari-

scope." This is a prohibition against a classification, based in part upon the number of degrees at which these sugars test, and in part upon a tabulation of the results of other tests of other sugars in other years. The reason of the prohibition is immaterial, but is obvious enough. These former tests of different sugars could properly be considered only upon the unproved assumption that except for a difference in their pure sucrose content, the chemically pure sugars of the table and the raw sugars under examination are identical in their effect upon the polarized ray of the polariscope—an assumption contrary to the conceded fact that raffinose, dextrose and levulose are present in the latter and polariscopically active (Dr. Wiley's testimony, p. 98 and 108, Bureau of Chemistry Bulletin, *supra*).

2. The act likewise requires that the sugars shall be "tested by the polariscope," and classified for duty according to the number of degrees "shown by the polariscopic test," *i. e.*, shown upon the Ventzke scale of the polariscope. This is an enactment that when the sugars have been tested by the polariscope, and a certain number of degrees shown by the polariscopic test, the inquiry shall cease with the standard of classification thus ascertained; and that by this both Government and importer shall abide. Up to that point, if there be different methods of conducting the test, *i. e.*, of manipulating the instrument, and the sugar solution which is placed in it, undoubtedly Treasury Regulations may select and prescribe one of these methods to be followed rather than others. But when the number of degrees has thus been shown by the polariscopic test, the act of then consulting a table, and in accordance with its directions adding to or taking away from the number of degrees shown by the test itself, cannot, without an abuse of language, be styled a method of conducting the test. It is a method of falsifying the test, to which the Treasury Department is not authorized to compel the importer to submit.

3. The requirement of the act that imported sugars shall be classified for duty according to the "number of degrees shown by the polariscopic test" is itself an inhibition against classifying them instead of according to "the percentage of pure sucrose contained in the sugar"; for the one is well known to be merely a ready means of obtaining an approximation to the other. To make so-called "corrections" to the one in order to convert it into the other is simply to substitute for the prescribed standard of classification, one which Congress refused to prescribe. If these so-called "corrections" were to be taken from a table showing the variations between the polariscopic test under similar circumstances of other sugars, whether similar or dissimilar, and the true percentage of sucrose content of these sugars as subsequently ascertained either by the Clerget test or chemical analysis, doubtless no one could be found to justify such a perversion of the polariscopic test as "a method of conducting a polariscopic test." The principal is no different where the "correction factor" supposed to be necessary to convert the polariscopic test into the percentage of sucrose content has been ascertained, not by chemical analysis, but by polarizations of a different sugar at a different temperature at a different time.

To require the polariscope to be graduated for the temperature at which the test is to be taken is a method of conducting the test. To require the test to be taken at the temperature at which the polariscope is graduated is likewise a method of conducting the test. To conduct the test to a result, and then to change this to some other result on the plea that it would have been attained if a different polariscope than the one employed had been used, or if the test had been taken at a different temperature than the one which did prevail, is in either case to depart from the standard prescribed by the act and to substitute for it guess-

work—how good or how bad guesswork is immaterial.

As Congress chose to prescribe for the standard of classification the rough but ready polariscopic test instead of the accurate "percentage of pure sucrose content," it is again immaterial whether there be a good reason for its choice; and, again, the reason is obvious enough. The standard of classification should be one capable of application and practice, not merely by governmental experts in their laboratories, but by the importing merchant. Since he must in his purchases and sales be governed by it, he must in fairness be able to apply it and ascertain it. The polariscopic test as in universal use in the trade and in the Treasury Department until the regulations in question, is such a test which the merchant can make for himself, and by which he can check the official test when made by the Government. The percentage of pure sucrose content, on the other hand, can be ascertained only by careful and tedious processes incapable of application to ordinary business either by the Government appraiser or by the merchant. For that reason it is that the polariscopic test is prescribed as the standard of classification, and to that the Treasury Department should be required to adhere.

Conclusion.

The judgment of the Circuit Court should be reversed and the case remitted to it with instructions to reverse the decision of the Board of Appraisers and direct a reclassification of the sugars in accordance with their polariscopic test, without making to it the additions required by the Treasury Regulations in question.

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APPENDIX A.

Summary of evidence as to meaning of the phrases "polariscopic test" and "testing by the polariscope" as understood at and prior to the time of the passage of the Act of July 24, 1897.

Dr. F. W. Wischmann, Chief Chemist of the American Sugar Refining Company, graduate 1881 of the School of Mines of Columbia College, assistant to Professor Chandler, professor of chemistry in Columbia College; 1882–3, student at University of Berlin; 1883–1897, instructor in chemistry at Columbia University; 1883 to date "connected with the sugar "industry in New York and vicinity," "given special "study to the question of sugar chemistry" (p. 21); 1897 delegate to and honorary vice-president of the session of the Third International Congress of Applied Chemistry meeting at Vienna (pp. 35, 148); delegate and secretary to the International Commission for the Unification of Sugar Analysis, Paris 1900 (pp. 421, 422, 612).

"The test to which I refer to the best of my knowledge and belief, is used by all buyers and sellers in the United States and with perhaps only a difference of weight in sample, is employed to the best of my knowledge and belief in all countries in which the buying and selling of sugars goes on constantly" (pp. 21–22).

"The commercial method of testing sugar, which I believe is in general use is as follows. * * * I know of no exception to it." (The witness then describes the same method prescribed by the Treasury Regulations of 1883, *supra*, p. 23). * * *

"This method that I have just described has been in use, common use, for many years; in fact, it is the method upon which the graduation of the instrument is based. The method

just described is the method adopted for the use of the polariscope many years ago. It is used in many laboratories in Germany; and in the United States it may be acknowledged as being the only method and it is referred to in all standard works on sugar chemistry. * * * Foremost and first of all Prof. Wiley in his valuable work on Agricultural Analysis, Fruehling and Shulz, Prof. Landolt's work. * * * Dr. Tucker's work on sugar analysis, and in fact, I know of no standard work but what refers to this method. Dr. Sidersky's work also" (p. 24).

"Q. In the course of your experience in testing sugars, have you ever heard of any sugar being bought and sold upon test obtained by the methods (since 1897) adopted by the Treasury Department? A. I have not.

"Q. Do you know of any scientific body or authority in the entire commercial world or in the scientific world that has given approval to this method of testing sugar? A. I do not" (p. 26).

John A. Sherer (commercial sugar chemist for twenty years) (p 37):

"Q. Will you please state during your experience in the last twenty years, what has been the method of testing sugar in the trade and by the Government up to the date these regulations of 1897 took effect? A. By the trade was that described by Dr. Wiechmann, his testimony exactly."

Q. What was the method by the Government? A. A. The Government method was practically the same up to the time of the introduction of these regulations now in force (p. 38). * * * During the whole of the *ad valorem* act of 1894 sugars were tested by the U. S. laboratories, all imported sugars were tested and under the method adopted previous to the adoption of the present regulations. Under the former regulations" (p. 38).

"Q. Up to the time of the issuance of the present (regulations) they were working under what regulations? A. Regulations of 1883" (p. 38).

"By Judge Somerville:

"Q. Any difference, Mr. Sherer, as you understand it, between the methods prescribed by these

regulations that you have in your hand (those of 1883), and the method which you say was commonly adopted by the trade in testing sugar? A. None whatever.

"By Mr. Tingle:

"Q. I hand you also the regulations under the act of August 28th, 1894, and desire to have that also marked in evidence? A. I see no difference between these two. There may be a difference in words but in general they are the same" (p. 39).

Joseph A. Deghuee (for three years assistant chemist in New York City Food and Health Department laboratory, and now chief chemist to Board of Health):

"Q. You are acquainted with the general method as used by chemists in general for testing sugar in New York? A. I am.

"Q. Do you know whether that method has been closely followed by all chemists? A. That is the method accepted by all authorities that I know of. * * * That is the method pursued by you (me) in making tests which you (I) understand to be the method used in the trade" (*i. e.*, the commercial method) (pp. 45, 46).

Edward Wolfbauer (chemist and mechanical engineer: four years' experience in the sugar business in France and six years in the United States) (p. 50):

"Q. State what you understand to be the method of examination under the standard regulations used in commerce, the standard method?"

(The witness describes the method as prescribed by the Treasury Regulations of 1883.)

Edward Sherer (sugar chemist since 1872; in Government service 1880 to 1898; "employed during "that time specifically in charge of the polarization "of sugar connected with the appraiser's office") (fol. p. 54).

"Q. Are you familiar with what is known as the standard or commercial method of testing sugar used generally in the trade? A. Yes, sir.

"Q. Was that method used by the Government in its laboratories? A. That was substantially the one adopted by the Government in 1880.

"Q. Used from that time continuously? A. Used continuously up to the recent regulations of 1897 (p. 54). * * * During the latter part of my stay in the Government service the number of samples tested per year were from 35,000 to 40,000 and very often during the busy season I read from 100 to 150 tubes a day.

"Q. Do you mean that you made all these observations personally? A. So far as reading the solutions in the polariscope were concerned" (p. 447).

Edwin A. Zeller, Jr. (sixteen years in the buying department of the Franklin and Spreckles Refineries in Philadelphia, Pa.) (p. 65):

"Sugars are bought on their polariscopic test. * * * The merchant buying sugars on polariscopic tests understands it to be that percentage which would be certified by a public chemist on samples that are submitted to the public chemist.

"Q. Are the certificates of public chemists or polariscopists always received in the trade as the correct test of the sugar? A. Yes, sir. * * *

"Q. How is that test known? A. As the polaricopic test" (p. 65). * * *

"Q. Does that custom prevail generally in the trade? A. Yes, sir.

"Q. Throughout the country? A. I understand so, yes, sir" (p. 65).

"By Judge Somerville:

"Q. How long has that been the case? A. Since I first went into the sugar business about sixteen years ago, sugars have been bought and sold on the sample as tested; that has been the practice since the polariscope became of use for all transactions in sugar.

"Q. Is there any particular method of testing by the polariscope in use? A. My understanding of the matter—I am not a chemist—was that there was a system, the same system used by all chemists, all public chemists" (p. 66).

W. S. Chance (witness for the Government), Supervising Special Agent of the Treasury Department (p. 74):

"Q. Do you not know that the sugars that were imported at this port under the Act of 1894, do you not know that the sugar was invariably tested at the laboratory? A. I do.

"Q. Under what regulations were they tested? A. Under the regulations similar to those which prevailed under the Act of 1883, and perhaps identical with them.

"Q. Was not the value of the sugar based upon the polariscopic tests made by the appraiser or his office? A. The appraiser's value, as determined by the polariscope, in the main was not based upon a polariscopic test of the sugars made by him, as I have just stated, but was based upon the settlement test, and the appraiser's test was simply collateral verification of the settlement tests" (p. 86); (*i. e.*, the result of the tests made according to the commercial method by the trade chemist employed by the buyer and seller).

Harvey W. Wiley, witness for the Government, chief chemist of the Department of Agriculture, Washington (p. 87):

"By Judge Somerville:

"Q. Are you familiar with the methods of polarizing sugar used by the commercial houses? Please state them? A. Yes, sir. The method was so well stated by Dr. Wiechmann, and met my entire approval, I will let his statement stand as mine (pp. 90, 91). * * *

"Q. Do you know whether or not these private chemists (*i. e.*, trade chemists, as distinguished from those in the employ of the Government), took into consideration any allowance for temperature in testing, or have you any knowledge on that subject? A. Yes, I have knowledge of absolutely what they said and I never found one who made any correction for temperature" (pp. 100, 101). * * *

"Q. Do you regard the tests made by trade chemists in use by them as a scientific test? A. I do. * * * The method pursued by the trade when performed under the conditions at which their

instruments are graduated and accurately performed will lead to correct results" (p. 106).

THE TARIFF ACT OF OCTOBER 1, 1890.

SECTION 237. "All sugars above No. 16 Dutch standard in color shall pay a duty of five-tenths of one cent per pound."

FREE LIST.

SECTION 726. "Sugars, all not above number sixteen Dutch standard in color," &c.

(Under this act, all imported sugar, either paying a specific duty per pound or coming in free, no polariscopic tests of them were made by the Government.)

THE TARIFF ACT OF AUGUST 27, 1894.

SECTION 182½. "There shall be levied, collected and paid on all sugars, &c., a duty of forty per centum *ad valorem*."

TREASURY REGULATIONS OF MAY 13, 1895.

(Pp. 163–173.) "The following regulations for the sampling and classification of sugars and molasses under the provisions of the tariff act of August 28th, 1894, and for the polarization of sugars as an aid in determining their dutiable value, are prescribed for the guidance of custom officers" (p. 163).

(Then follow directions for sampling and for making the polariscopic test (pp. 170–173), the latter in all essential respects identical to those prescribed by the regulations of 1883 and followed by the trade chemists.)

Testimony taken for the first time in the Circuit Court.

Charles A. Crampton, chemist, Internal Revenue office (witness for the Government, p. 112):

"I don't want to put on record as assuming that all commercial polarizations are conducted without

reference to the influence that the temperature has; because I have in my own experience found some commercial chemists who do make the allowance of temperature, and notably in one case which I would be glad to testify to" (p. 386).

"Q. Is there anything, so far as you know, as a uniform commercial test? A. No, sir.

"Q. Have you ever been a commercial chemist? A. No, sir.

"Q. Had no experience in that? A. No, sir" (p. 391). * * * "I don't know of any peculiar system of testing sugars which is commonly known as commercial testing.

"Q. Don't you know that there is a method of testing sugar used by trade chemists? A. Trade chemists use methods for testing sugar.

"Q. Do you know what that method is? A. I know there are methods of testing used by commercial chemists. Just what particular prescribed method is used I couldn't say.

"Q. Don't you know that there is a particular prescribed method of testing sugar that is used by commercial chemists, and which was used by the Treasury Department up to the date when these Regulations of 1897 went into effect? A. No, I simply know that this allowance for temperature" (prescribed by the Regulations of 1897) "was not made by commercial chemists as a general thing, to the best of my knowledge, prior to the promulgation of the Regulation of the Internal Revenue Office" (p. 392).

Andrew Braid, Assistant of the United States Coast and Geodetic Survey (witness for the Government; p. 394):

"Some trade chemists have been aware of it" (the temperature correction required by the Regulations of p. 396) "for a long time, and have used it.

"Q. Who, for instance? A. You have had witnesses here already. There is Professor Harrison, for example, from British Guiana.

"Q. I am speaking of chemists in this country. A. There is one of the trade chemists of Boston—I don't remember his name—when he was spoken to about it, when we were in Boston on our trip of inspection of the Custom House laboratories, he

stated distinctly that he had always used it, and he was sorry for his brother chemists that had failed to use it and were not aware of it.

"Q. Can you give us his name? A. I couldn't give you his name just now" (p. 396).

Harvey W. Wiley, witness for the Government (p. 399):

"I know of no established method established by law or by common agreement which may be called the commercial method. I have never seen any statement of agreement among commercial chemists" (p. 402).

Harwood Huntington, consulting chemist and for three or four years commercial sugar chemist (p. 405), witness for the Government:

"Q. Up to May last how long had you been engaged in making commercial tests? A. Between three and four years.

"Q. And were you in the habit while making those commercial tests of applying this correction of .03?" (the so-called temperature correction called for in the Regulations of 1897). "A. No, sir" (p. 415).

George Grund, trade chemist (in New York since 1883, testing annually two thousand to three thousand samples a year, to wit, about one-third of all the imported sugars, p. 424). The witness describes as his method of testing sugars by the polariscope the commercial method prescribed by the Regulations of 1883, p. 425):

"Q. Have you practiced this method of testing sugars in other countries than America? A. In Cuba, in Germany. * * *

"Q. Do you know of any other method in use by commercial chemists in this country? A. No, sir.

"Q. Have you ever used any other method? A. No, sir.

"Q. Have you ever made, or ever heard of any other trade chemists making, either in Cuba or in this country or in Europe, additions and substrac-

tions from the reading on the polariscope due to the supposed influeuce of temperature upon the solution? A. No. sir" (pp. 425–426).

Frank W. Bennett, trade chemist, engaged for the past twenty-five years in Boston, Massachusetts, in testing sugars by the polariscope—practically all of the sugars brought into that port (pp. 429–430).

The witness describes as his method of testing sugars by the polariscope the commercial method prescribed by the Regulations of 1883:

"Q. And the absolute reading of the polariscope is reported to your client as the correct reading? A. Yes, without any change.

"Q. Do you know anything of the method adopted by your rival chemist in Boston" (there is only one, p. 431)? "A. I am familiar with his method.

"Q. In what respect does his differ from yours? A. Only in using a smaller quantity.

"Q. Does he make any addition to the reading for supposed errors due to temperature? A. I am quite sure that he does not.

"Q. Have you ever known of such additions being made by trade chemists? A. I have not" (pp. 431–432).

Stephen P. Sharples, engaged at Boston as a commercial chemist, testing sugars, imported sugars, since 1871, testing all that come to the Port of Boston, senior partner of the witness Frank W. Bennett (p. 433):

"Q. Will you describe the method pursued in your laboratory after you have obtained the sample for testing? A. Mr. Bennett has already described that method. * * * I heard his testimony.

"Q. Have you anything to add to or take away from it? A. No, sir" (p. 434.) * * *

"During any of the time while you have been testing sugar for commercial purposes has it been your practice to make any additions to or subtractions from the reading of your polariscope with regard to the different temperatures at which the read-

ings were taken? A. There have been no corrections made by us.

"Q. What do you know about the practice of other trade chemists in that regard? A. I know it is not done in Boston by Mr. Eyster" (the only other trade chemist there), 'or myself. * * * The question of making this temperature correction had never been mooted in any way there until the Government issued their instructions to their chemists for temperature corrections" (*i. e.*, the Regulations of 1897). "At that time we talked it over somewhat and concluded that we would not make any additions to make corrections. * * * Our reasons were that we considered generally the sugars tested were tested rather higher than they really were, and to add to this further correction and still further raise it would throw out the test still further. * * * The whole handling of the sugar from the time it leaves the vessel has a tendency to dry the sugar, * * * and thereby increase its test" (pp. 435, 436).

Gottfried Landsmann, for twenty three years engaged in the business of testing sugar by the polariscope, for eight years examiner in the Appraiser's Office, New York, for the last eight years as trade chemist in Philadelphia, testing practically all the sugar brought into that port (p. 437).

The witness describes as his method of testing sugars by the polariscope the commercial method prescribed by the Regulations of 1883:

"Q. Do you make any correction in the reading for the difference in temperature between that at which the reading was made and the temperature at which the instrument is standarized? A. No, sir.

"Q. Have you ever done so during your experience as a chemist? A. No, I never did.

"Q. Do you know about the practice of other trade chemists in this regard? A. All the other chemists I have met in the laboratories where I have worked the method of testing mentioned has been followed.

"Q. Was the method that you have described the one pursued in the United States Laboratory while you were there? A. That method was used in the

United States Laboratory at the time I was there" (pp. 437-438). * * *

"Q. You just followed your usual custom? A. Not only mine, but the custom of all the chemists that I ever met, and I have met a good many" (p. 439).

Morris Hasenclever, ex-Assistant Professor in the Laboratory of the University of Berlin, for sixteen years trade chemist in New York, testing practically all of the sugar brought into this port (p. 440).

This witness describes as his method of testing sugars by the polariscope, the commercial method prescribed by the regulations of 1883:

"Q. What do you know about the method pursued by other trade chemists? How does it compare with yours? A. I don't know of any except from what I have heard. I never have seen anything done.

"Q. So far as you have heard of the methods adopted by other trade chemists, do they or not agree with yours? A. I heard they put .3 to the readings.

"Q. Whom have you heard do that? A. I heard that the Goverment does that.

"Q. Do you know of any trade chemist not in the employ of the Government who make that addition? A. No; nobody does that" (pp. 441-442).

The only two instances proved of the use anywhere of any other than the "Commercial Test," and how these two exceptions only "prove the rule."

1. Although it is literally true that down to the adoption of the Treasury Regulations of October, 1897, the "commercial test" was the only one in use either by the trade or the Treasury Department itself in testing imported sugars, it is also true that another method, and substantially the one now prescribed, by these Treasury Regulations of 1897, had been adopted in August, 1892, by the Internal Revenue office in ascertaining the amount of bounties

payable on domestic sugars under the Tariff Law of October 1, 1890; and followed for *two years*, viz., until the repeal of the Tariff Act of 1890 by that of August 27, 1894. The regulations of the Internal Revenue office adopting this new method were drafted by a commission consisting of Dr. Harvey W. Wiley, Chief Chemist in the Agricultural Department; O. H. Tittman, the officer in charge of weights and measures; and Charles A. Crampton, Chemist of the Internal Revenue office (p. 113). Prof. Wiley, in giving his assent to these regulations, relied chiefly upon the work of Mr. Tittman of the Coast and Geodetic Survey (p. 101), as he was obliged to explain upon the witness stand in the present trial. Prof. Wiley was himself as late as January, 1897, on record in his book in Agriculture Analysis (pp. 100–101) as stating that " tem- " perature had very little influence upon the results " of polarization of sugars " (p. 100), " was negli- " gible " (p. 101). " At that time " (to wit, January 1897), Prof. Wiley says, " I had not investigated " the subject myself from that point of view " (p. 100). The second member of the commission, Mr. Crampton, likewise admitted that he likewise had not personally participated in the experiments (p. 116), and indeed, testified in so many words that the innovations of these regulations " were based upon the recommendations of Mr. Tittman " (p. 123).

The record of these investigations of Mr. Tittman was not produced in evidence by the Government, although it had been embodied in a report made by Mr. Tittman to the Government, which the counsel for the importers formally requested the counsel for the Government to produce (p. 375). Without this, the only account of the nature of these experiments which Mr. Tittman could give, was from recollection only, he having no notes or memoranda of them (pp. 371, 372, 373).

Under these regulations for two years bounties were paid by the Internal Revenue Department upon the production of domestic sugar, which were

greater by the amount of the temperature correction than could otherwise have been demanded. The necessary result was that no one questioned the justice or validity of this provision of the regulations.

2. It is an interesting coincidence that the same situation explains the only other instance where, so far as the Government was able to show, any correction for temperature has ever been made in practice to the observed polariscopic test of sugars. It was not apparently until all parts of the civilized world which would ordinarily occur to the inquirer had been searched in vain for this phenomenon that it was at last found to have occurred in British Guiana, South America. The Government did establish by the testimony of one Prof. Harrison, Government Analyst at Georgetown, British Guiana, that he and his predecessor there had been in the habit of adding to the observed reading of the polariscope a correc- of .3° as "the correction for the temperature be- "tween the standard temperature at which the "instruments were made [17.5°] and the tempera- "ture at which they were used," "28° C., which is "our average temperature in British Guiana" (pp. 346, 345).

In a paper written by him which the Government put in evidence (pp. 603–606), Prof. Harrison informed the Planters' Association of British Guiana, in October, 1894, that in his opinion without this temperature correction "the seller is the loser to the "extent of .35 of one per cent" (p. 604). He also, *erroneously*, informed them that the "system of "correction" which he urged them to adopt "is in "use in the Custom House laboratory" of the United States (p. 605). As the Planters' Association is composed entirely of sellers of sugar, interested to obtain the highest possible polariscopic test for their sugars, it is not surprising that the use of the temperature correction recommended "was accepted by "the Planters' Asssociation of British Guiana as the "official method for polarizing sugars in that

"Colony in June, 1894, when the question came "up" (p. 348).

Such was the origin of the fact that British Guiana alone, among all the sugar countries of the world, sanctions the addition of a temperature correction to the polariscopic test.

APPENDIX B.

The attempt of the Government to justify its requirement that an arbitrary addition of .3° V. for each increase of 10° C. over the standard temperature shall be made to the observed reading of the polariscope, and that the sugar shall be classified for duty as testing the amount thus increased, is based upon the reported results of the following experiments:

(*a*) A series of polariscopic readings made by Prof. Wiley, in April, 1898. These were reported by him in detail in his article on the Specific Rotation of Sucrose, published in the Journal of the American Chemical Society, July, 1889; and understood to be in evidence, although not printed in that case. It is upon these readings that the tables of corrections incorporated into the Treasury Regulations of February 17, 1899 (pp. 175, 328, 331-332) is based.

(*b*) A series of polariscopic readings made by Dr. Wiley and Dr. Peter T. Austin (p. 363), in December, 1899.

(*c*) A series of polariscopic readings made by Prof. Henry Morton and Dr. Harvard Huntington, in January and February, 1900 (p. 366).

(*d*) A series of polariscopic readings made by Mr. O. H. Tittmann, Charles A. Crampton and Andrew Braid in November, 1899 (p. 376).

The differences between the readings made by these observers at different temperatures have been averaged by them, with the apparent result of indicating in the observed polarizations of a given sugar an average decrease of .3° V. for each 10° C. of the difference between the temperature at which the polarization was made and the standard temperature of .17.5° C.

1. One serious source of error in Dr. Wiley's experiments in April, 1898, is that they were readings, not of the solution of sugar plus the usual clarifying agents only, to their own readings of which the Custom House Examiners are by the Regulations required to apply the supposed results of these experiments; but of a solution of sugar and mercuric chloride. This was kept in stock during the four days during which the experiments continued, and during this time was subjected to the certainty of more or less chemical change, loss by evaporation, &c. Comparisons of readings of this solution as it was when first made and as it was after it had stood for four days, cannot be accepted as a sufficient basis for requiring the American Sugar Refining Company, for instance, to pay $147,000 annually more in duties than it otherwise would (p. 641). The criticisms made by Dr. Wiechmann upon such a method of ascertaining the influence of temperature in the rotatory power of pure sucrose (pp. 636–637) have never been answered by Prof. Wiley. The justice of them has in substance been admitted by another witness for the Government, Dr. Peter T. Austin (p. 362):

"Q. Would you regard it as a correct method to "make a stock solution and test sugars on different "days of that particular solution? A. Well, I think "that would depend a great deal upon the person.

"Q. Would you do busi[illegible] that way? A. I "wouldn't do it in a court c[illegible]se in that way, because "I should want to take ev[illegible]ry possible precaution" (p. 362).

Indeed, the Government itself may be said to have admitted the justice of the criticism; for it has not been willing to rest its case upon this series of experiments, elaborate and long continued as they were; but has caused the other series of experiments above enumerated to be made, and in each one of them a fresh solution to be made up for each polarization. Prof. Wiley's first series of experiments can in fairness be said to prove nothing but that polarisations of a solution of mercuric chloride and sugar made at a certain temperature on one day, and at a different temperature four days later, will, assuming the absence of other sources of error, differ by .03° V. for each degree Cent. by which the temperatures differ.

2. The second set of readings, relied upon by the Government, were made by Prof. Wiley and Dr. P. T. Austin, checked by Mr. Chapman, one of the official polarizers at the United States Appraisers Stores, and by Mr. Maywald, Dr. Austin's assistant. All the readings, "agreeing closely" (p. 363), made in December, 1899, were made at three different temperatures only—to wit: 6° C., 25.5° C. and 36.5° C. (pp. 360–361). Of these the reading at 6° C. (42.8° F.) is at a temperature that does not obtain "under the conditions that existed in the practical "analysis of sugars as carried on in the Department" (pp. 360–361); and the behavior of the polariscope at that temperature has no bearing upon the only question in this case—to wit: its behavior at the temperatures under which polariscopic tests are, in fact, made by the Custom House Examiners—to wit: say from 17.5° C. to 27.5° C. (63.5° F. to 81.5° F.)

The same consideration would justly exclude from consideration the reading obtained by him at 36.5°

C.—to wit: 97.7° F., a temperature at which, it is safe to say, not one reading in a hundred is taken by the Custom House examiners.

Waiving this objection, however, the readings at these two temperatures were as follows:

Reading at 25.5° C., 99.80° V.
" " 36.5° C., 99.65° V.

These were " the exact readings " (p. 363) without " any corrections of any kind " by Jobin's formula or otherwise. They were, moreover, as the readings themselves show, readings of a solution of " practically chemically pure sugar " (p. 363). Hence, although " a small amount " of basic acetate of lead, although my solution " was practically clear enough to polarize it without " it," was added, there could have been no precipitate of foreign substances to displace any part of the sugar solution, and so dispense with the necessity of Jobin's correction as heretofore considered.

It follows that the two readings at 25.5° C. and 36.5° C. were each too low by the amount of Jobin's correction necessary to compensate for the increase in volume of the quartz wedges at that temperature over the standard one of 17.5°. Applying Jobin's formula—" Polarization: + [0.00016T] N " (p. 455), to Dr. Austin's and Prof. Wiley's reading of 99.80 at 25.5° C., and of 939.65 at 36.5° C., they become, respectively, 99.93° V. and 99.95° V.

In other words, after making the necessary correction by Jobin's formula for the expansion of the quartz wedges, Prof. Wiley's and Dr. Austin's readings, at temperatures wider apart than ever prevail in actual practice, 17.5° C. and 36.5° C. (63.5° F. and 97.7° F.), *are identical*, the difference between 99.93 and 99.95 being far less than that which would necessarily be ignored in actual practice.

Prof. Wiley's and Dr. Austin's own experiments, therefore, prove that the true polarization of this

sugar was 99.94°, the mean of their two readings. Let us see what would have been the test of this sugar which he official examiner would have been obliged to report and upon which the importer would have had to pay duty if the Treasury regulations were followed. The reading at 25.5° C. was 99.8. The addition required by Prof. Wiley's table for this reading at this temperature is .265. The official test of this sugar would, therefore, have been 100.065. It was, therefore, a sugar .065° V, more than chemically pure. This, of course, is nonsense; but it is into that domain that the application of the temperature corrections of Prof. Wiley's table inevitably leads, as will be seen more in detail hereafter.

3. The experiments of Prof. Morton in January and February, 1900, consisted of readings at two temperatures only, viz.: 5° C. and 32.5° C. The averages of the readings were respectively, 100.42° and 99.6°.

Prof. Morton's readings at 5° C. must, for the same reasons as Dr. Austin's at 6° C., be disregarded. The behavior of the polariscope at temperatures at which it is never used in practice obviously cannot be used to justify the addition of arbitrary corrections due to its supposed behavior at the temperatures which do obtain in practice.

Charles A. Crampton, witness for the Government, chemist to the office of Internal Revenue of the Treasury Department:

"Q. As a matter of fact and a matter of practice is the temperature ever lower than 17.5 in the laboratories of the various Appraisers' offices in the country? A. Speaking now about Appraisers' offices?

"Q. Yes. A. No. I have never seen Appraisers' laboratories lower than 17.5.

"Q. They are always higher, aren't they? A. I think they are" (p. 384).

Harwood Huntington, a witness for the Government, consulting chemist and ex-trade chemist:

"Q. At what temperatures are commercial readings with the polariscope made? A. As near the 17.5° C. as the case may be. * * *

"Q. As a rule they are made at a temperature about or near 17.5° C.? A. Yes, as near 17.5° C. as may be. Of course on warm days it might be at a higher temperature.

"Q. Have you in your practice as a commercial chemist made readings for commercial purposes at temperatures below 17.5° C.? A. I would not do so. If the fire went out I would not want to make the reading.

"Q. And they are not made in practice? A. I could not speak for other chemists. I don't think it would be natural to make them under abnormal circumstances.

"Q. And a reading below 17.5° would be abnormal, would it not? A. I wouldn't make them myself" (p. 414).

Edward Sherer, United States Polariscopic Examiner in Chief from 1880 to 1898:

"On very cold days it [the temperature of the sugar room] fell as low as 20°, but it oftentimes goes as high as 24° and even higher. Our object of course was to get the temperature up when the weather was cold. As soon as possible every effort was made to do this, in lighting gas stoves and burners in the room.

"Q. What temperature did you endeavor to keep the room at? A. Somewhere in the neighborhood of 22 or 23°. We didn't wish it less than that.

"Q. And it fell occasionally two degrees below that and sometimes one or two degrees above that? A. I should say the average was somewhere between 22 and 23" (p. 472).

Of Prof. Morton's readings, therefore, there is left to be considered but one, at the temperature of 32.5° C. As he took no readings at any normal

temperature to compare with this, his deductions are obviously valueless for the purpose of this case.

It should be added that, although Prof. Morton is undoubtedly familiar with the use of the polariscope for scientific research in the lecture room, he is so obviously unfamilar with the method of applying it to the testing of sugar solutions, *i. e.*, to its use as a saccharimeter, that if he had made observations which could be compared it would have been necessary to disregard their results. He was unacquainted with Jobin's formula (p. 368); supposed the boneblack when necessary could be added to the solution in the flask; this for obvious reasons has never been allowed until the exact volume of the necessary solution has been first obtained in the flask (pp. 159–160), and he actually testified that it was not necessary to bring the contents of the flask up to the graduated point (fol. 370).

4. The same criticisms apply to the readings by Dr. Harwood Huntington in January and February, 1900. He testified to readings at two temperatures only, to wit, 10° C. and 23° C.—the first at a temperture far below that at which tests are permitted to be made in the United States laboratories. But if any significance can be attached to his readings they, like the joint readings of Dr. Austin and Prof. Wiley, concur with all the readings of the witnesses for the importers, whose testimony is hereafter to be considered, in establishing that the observed polariscopic test of imported sugars at the Government laboratories is the true test without any addition whatever. Dr. Huntington's readings were:

Temperature.	Reading.
23° C.	99.8°
10° C.	100.2°

These are the readings of a chemically pure sugar to the solution of which the addition of acetate of lead would cause no precipitate. In fact, it does not appear that any of the acetate was added by Dr. Huntington. The observed readings at the two temperatures, therefore, depart, by reason of the contraction and expansion of quartz plates, from what would have been the reading at the normal temperature of 17.5° C. by the amount of Jobin's correction. Applying Jobin's correction these readings become respectively 99.89 and 100.08. These readings differ only by .19° V. They are, therefore, to be regarded as identical, since they are within the variation of 0.2° V. allowed by the United States regulation for errors of observation. Dr. Huntington's readings, therefore, simply show that the difference in his temperatures exerted no effect upon the polarizing of the sugar solution itself.

5. The last series of readings relied upon by the Government are the joint readings of Messrs. Braid, Crampton and Titman in November, 1899 (p. 376). The outcome of their work is set forth in detail in the tables Exhibit G (pp. 607, 609). These tables show that one set of polarizations was made on fifteen solutions at temperatures ranging from 15.0° C. to 22.3° C., the results of which are given in the so-called Low Temperature Table on page 607; and

Another set at temperatures ranging from 26.5° C. to 31.3° C., the results of which are given in the so-called High Temperature Table on page 609.

The obvious comment upon these tables is that they seem to show a system of "averaging" gone mad. The temperature at the beginning and end of each experiment is averaged; the reading of each solution by each observer is averaged; and then an average is taken of the average of each reading of each observer the average of the average of the

temperatures. In this way the average of all the readings of all the observers at all the temperatures is taken to have been 99.826 at the average low temperature, to wit, 19.076° C. and to have been 98.517 at the average high temperature, to wit, 28.857° C., showing an average difference of 8.309° V. for the average difference in temperatures of 9.781° C. It needs but a brief examination of the individual experiments to demonstrate that this system of averaging conceals numerous individual observations, the results of which were totally inconsistent with the average result thus obtained.

The subjoined table No. 1, compiled from Exhibit G, demonstrates, for instance, that in various instances almost identical polarizations are returned for varying temperatures and in other instances higher polarizations are actually returned for higher than for lower temperatures.

TABLE NO. 1.

Sol. No.	Temp.	Pol.
21 T	17.25° C.	99.88
25 C	19.60 "	99.84
1 C	21.50 "	99.84
2 B	22.15 "	99.78
5	27.75	99.72
11	28.65	99.73
8	28.00	99.58
12	28.60	99.64
19	30.30	99.67

Similarly from the subjoined table No. 2, it appears on the other hand that in various instances almost identical polarizations are returned for varying tem-

peratures, and, in other instances, higher polarizations are actually returned for higher than for lower temperatures.

TABLE NO. 2.

Solution No.	Temp.	Pol.	Difference in Temp.	Pol.	This amounts to a difference of degrees Ventzke for an increase in temperature of one degree Centigrade.
21 T 20 C	17.25 17.50	99.88 100.06	+0.25° C.	+0.18	+0.72
23 C 20 C	17.95 17.50	99.87 100.06	+0.45° C.	−0.19	−0.42
25 C 30 C	19.6 19.3	99.84 99.99	+0.30° C.	−0.15	−0.50
4 B 1 C	22.0 21.5	99.78 99.84	+0.5° C.	−0.06	−0.12
1 C 3 C	21.5 21.1	99.84 99.80	+0.4° C.	+0.04	+0.10
11 12	28.65 28.60	99.73 99.64	+0.05° C.	+0.09	+1.80
8 10	28.0 27.9	99.58 99.74	+0.10° C.	−0.16	−1.60
13 14	28.50 28.40	99.78 99.55	+0.10° C.	+0.23	+2.30
19 17	30.30 30.15	99.67 99.54	+0.15° C.	+0.13	+0.86

From table No. 2 it appears, for instance, that an increase of 1° C. in the temperature actually increases the polarization at one time by .72° V., at another time by .10°, at another time by .86°, at another time 2.30°; while the same increase at other times decreases the polarization, at one time by .12°, at another time by .42°, at another time by .50°, at another time by 1.60°.

In the face of these facts it would appear too obvious for argument that a "law" subject on occasions to such individual eccentricities as these, under the same circumstances sometimes increasing and sometimes decreasing the polarization, by amounts varying from + 2.30° to — 1.60°, is too uncertain a standard upon which to base an exaction of an increase of duties over those prescribed by the letter of the law.

The oft-quoted language of the Supreme Court in Hartranft *vs.* Wiegmann (121 U. S., 609), that "duties are never imposed on the citizen upon vague or under doubtful interpretations" of a tariff act, had never better application than to the facts here disclosed.

6. Waiving all the objections heretofore considered, and accepting as accurate and trustworthy the results of the different experiments of the different experts called by the Government, there remains an insuperable objection to admitting the conclusion to the establishment of which they are directed. The premise is that Prof. Wiley and his confrères in their careful experiments with special instruments capable of reading with an accuracy according to Dr. Wiley of five-hundredths of a degree (p. 89), to wit, four times that required of the examining polariscopists in the sugar room of the Appraisers' stores, find that their readings of a given solution of chemically pure sugar will diminish on an average of .3° V. for each difference

of 10° C. The conclusion is that these examining polariscopists will in actual work find the same difference in the readings of a solution at different temperatures, and therefore can and should add to their readings the same correction which Dr. Wiley determined he ought to add to his own to obtain the true polariscopic test.

The objection to admitting this conclusion is that it would be to ignore the radical differences in the circumstances under which the scientific tests of Dr. Wiley and his confrères and the commercial tests of the examining chemists at the Appraisers' stores are conducted. It is sufficient to refer to two.

(*a.*) The testimony shows that the range of temperature at which these tests are conducted is from 20° in the winter to the average temperature in the summer which would doubtless be placed unduly high at 27.5° C. (81.5° F.). Even if the average temperature be taken to be as high as 24° C., the correction required by Dr. Wiley's table for anything below pure sugars is less than .20°.

But, as has been seen, it is concededly impossible for any ordinary observer to read a polariscope with accuracy within .20°. In other words, it is uncertain whether the observed test of a given sugar will be 96.50° or 96.70°. Its true test may be 96.50°; and its observed and recorded test 96.70°. Yet these regulations require an invariable addition to its test of this same figure of .20°. It is obviously inadmissible to allow at the same time for an error of observation a margin of .20° and yet upon the theory that the observed test is .20° too low, requires a constant addition of this .20 to the observed test.

(*b.*) The large majority of all sugars tested by the Customs officers are raw sugars. To them, therefore, of necessity and by the requirements of these

regulations the addition of the acetate of lead is made, with the consequent formation of a precipitate in the flask. The consequent displacement of the sugar solution by this precipitate causes, according to the uncontradicted testimony in the case, a plus error more than sufficient to counterbalance the minus error due to the expansion of the quartz wedges. Dr. Wiley's correction of .3° V. for each 10° C. is made up, as has been seen, and as his own paper states of a correction of about 0.16° for the error caused by the expansion of the quartz wedges and of about 0.14° that caused by the supposed effect on the rotatory power of the sucrose. The result is that the too low reading of 0.16° due to the effect of the temperature upon the quartz wedges is, by the present regulations, compensated for twice; once by the formation of the precipitate in the flask, and a second time by the addition of the .16° included in Dr. Wiley's .3°. Upon his own theory there can be no justification in the case of raw sugars where clarifying agents are used, of any correction beyond .14° V. even for an increase of temperature of as much as 10° C. The real error, therefore, if any, which according to Dr. Wiley's own theory, occurs in the observed readings at the Appraiser's stores, is only one of from .005° V. to .015° V., as the temperature varies from 20° C. to 27° C. These are refinements which it is idle to consider, in view of the accepted fact that a polariscope cannot be read accurately by the ordinary observer within the larger figure of .20° V. The result is that the Treasury Regulations call for an arbitrary addition of twice what could be justified in any event; and that this one-half which might be justified is so small as to be notably less than the permitted error of observation.

APPENDIX C.

Summary of Argument for Importers.

The Treasury Regulations in question do not purport to conform to the Tariff Act of 1897.

(1.) The language of the Act of July 24, 1897,

> "*testing by the polariscope not above 75* degrees 95-100 of one cent per pound, *and for every additional degree shown by the polariscopic test* 35-1000 of one cent per pound additional and fractions of a degree in proportion,"

is identical with the language of the Tariff Act of March 3, 1883,

> "*testing by the polariscope not above 75 degrees* shall pay a duty of one and 40/100 per pound *and for every additional degree or fraction of a degree shown by the polariscopic test*, they shall pay 4/100 of a cent per pound additional."

The Treasury Regulations of May 22, 1883, were not only in force at the time of the passage of the Act of 1897, but they had been in force for a period of over fourteen years.

They correspond literally with the language of the Act of 1883; and equally with the language of the Act of 1897.

It cannot be claimed, it is not claimed that the same is true of the Treasury Regulations of 1897 in question.

From the beginning to the end of the brief for the Government the question whether the Regulations

of 1897 conform to the language of the Act is passed *sub silentio*, the argument being that the regulations serve more accurately to determine the content of sucrose.

This is avowed by the Regulations themselves:

> "79. The expression 'testing * * * degrees by the polariscope,' occurring in the act, is *construed* to mean the percentage of pure sucrose contained in the sugar as ascertained by polarimetric estimation" (p. 310).

But the regulations do not limit to polarimetric estimation. It is to the polarimetric estimation that they make the additions of which the importers complain.

(2.) The whole story is told in the table which is attached to the Treasury Regulations (*vide* same following p. 174, Record). The heading or statement with which it begins is:

> "Table of *Corrections* to Polarizations for Changes in Temperature from 4° to 40° and for Sugars of from 75 to 100 Per Cent. Purity, *Corrections* to be made for the Nearest Whole Degree *to the Observed Polarization. Add* Corrections when Temperatures are Above and Subtract when below 17°."

This table conforms to the Act of 1897, in that it starts as a basis with the "polarization" of the sugar, the "observed polarization." The changes prescribed by the table are stated in so many words to be *additions*. The language is "*add* corrections when temperatures are above and subtract when below 17°" (Centigrade, equal to 63.5° F.).

The assumption of the table is that duty shall be paid, not, as is the language of the Acts both of 1883 and of 1897, according to the polariscopic test, but according to a test which at only one single degree of temperature (17 degrees centigrade) corresponds with the polariscopic test.

What are "polarizations," what is "observed

polarization," is treated by the table as a matter which is not susceptible of dispute or difference.

This of itself puts beyond discussion the fact that what Congress was dealing with in passing the Act of 1897 was the polariscopic test as recognized in all commercial dealings, in the Act of 1883 and the Treasury Regulations to carry out its provisions and as declared by the Treasury Regulations of 1897.

(3.) As these Regulations were not promulgated until October 27, 1897, and as now sought to be enforced were revised on February 17, 1899, it goes without saying that they could not have been known to, and could not been in the contemplation of, Congress when the act was passed July 24, 1897.

(4.) The real question is whether the Treasury Department has the right, by what it calls putting a "construction" upon an Act of Congress, to create what is an entirely new and different Act.

The attempt on the part of the Treasury to do so leads to some curious results:

(*a.*) The commercial test, the test which has been in universal use, which is described by the language used both in the Act of 1883 and in that of 1897, the use of which was provided for in detail by the Treasury Regulations of 1883, is practical and convenient in ordinary transactions. It involves no reference to an arbitrary table. By it are governed the enormous transactions in sugar throughout the world, unless, as is claimed by the Government, there be an exception in British Guiana. Such an exception, if it exists, confirms the rule.

Just the reverse is the case with the Treasury Regulations complained of.

(*b.*) The use of the Treasury Regulations and the attempt to introduce as an element the scientific

percentage of sucrose in raw sugar leads to the result that in a large proportion of cases sugar, with the tests thus corrected, contains more than 100 per cent. of sucrose.

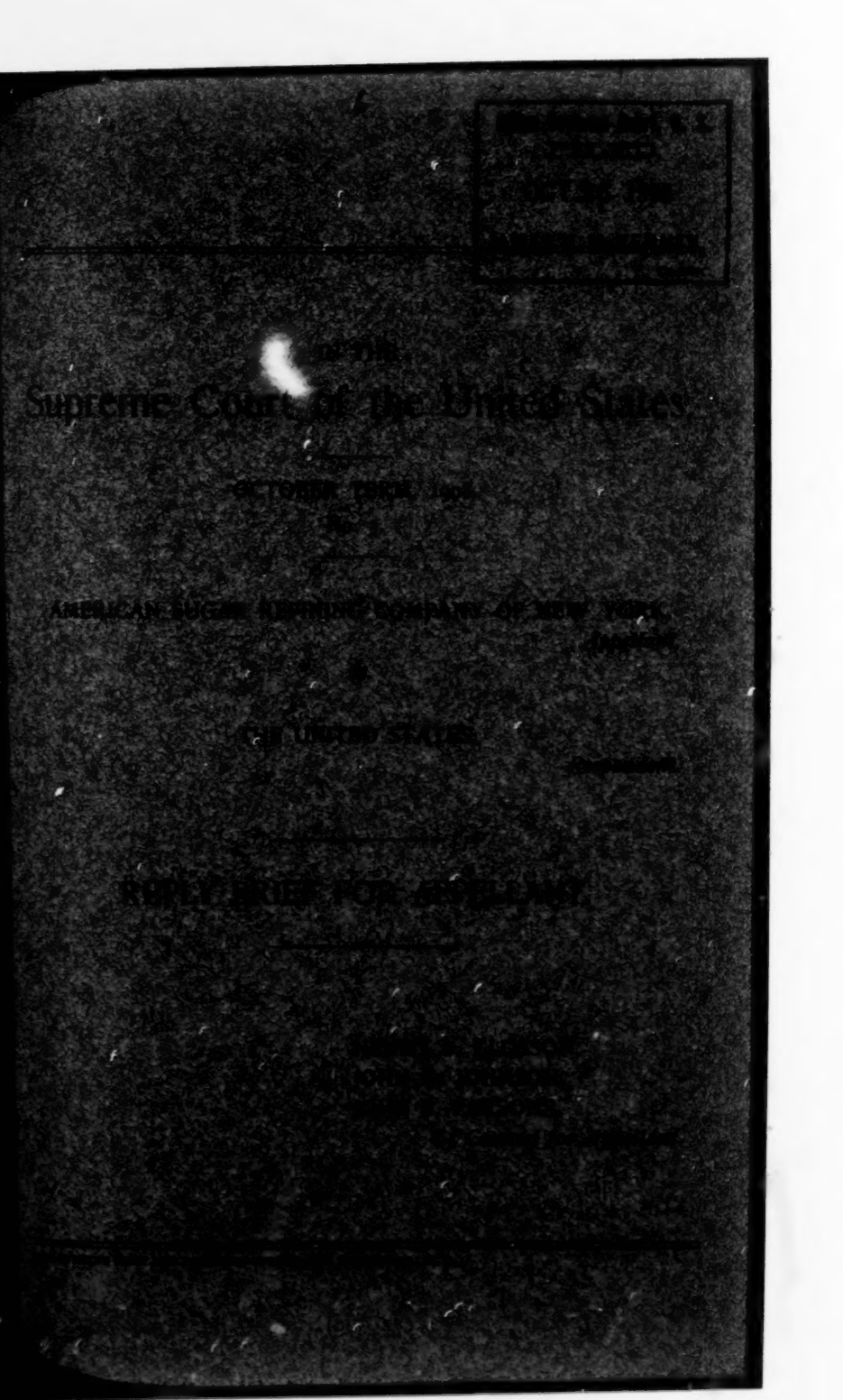
(c.) Applying the table of corrections and it must follow that the rate of duty as tested by the polariscope varies both according to the mean temperature of the port of entry, New Orleans, for example in one case, and Boston or Portland in the other, and according to differences of temperature for different days at the same port of entry. If duty is to be paid according to the polariscopic test, and the Treasury table be used the duty will be less or more according to the temperature.

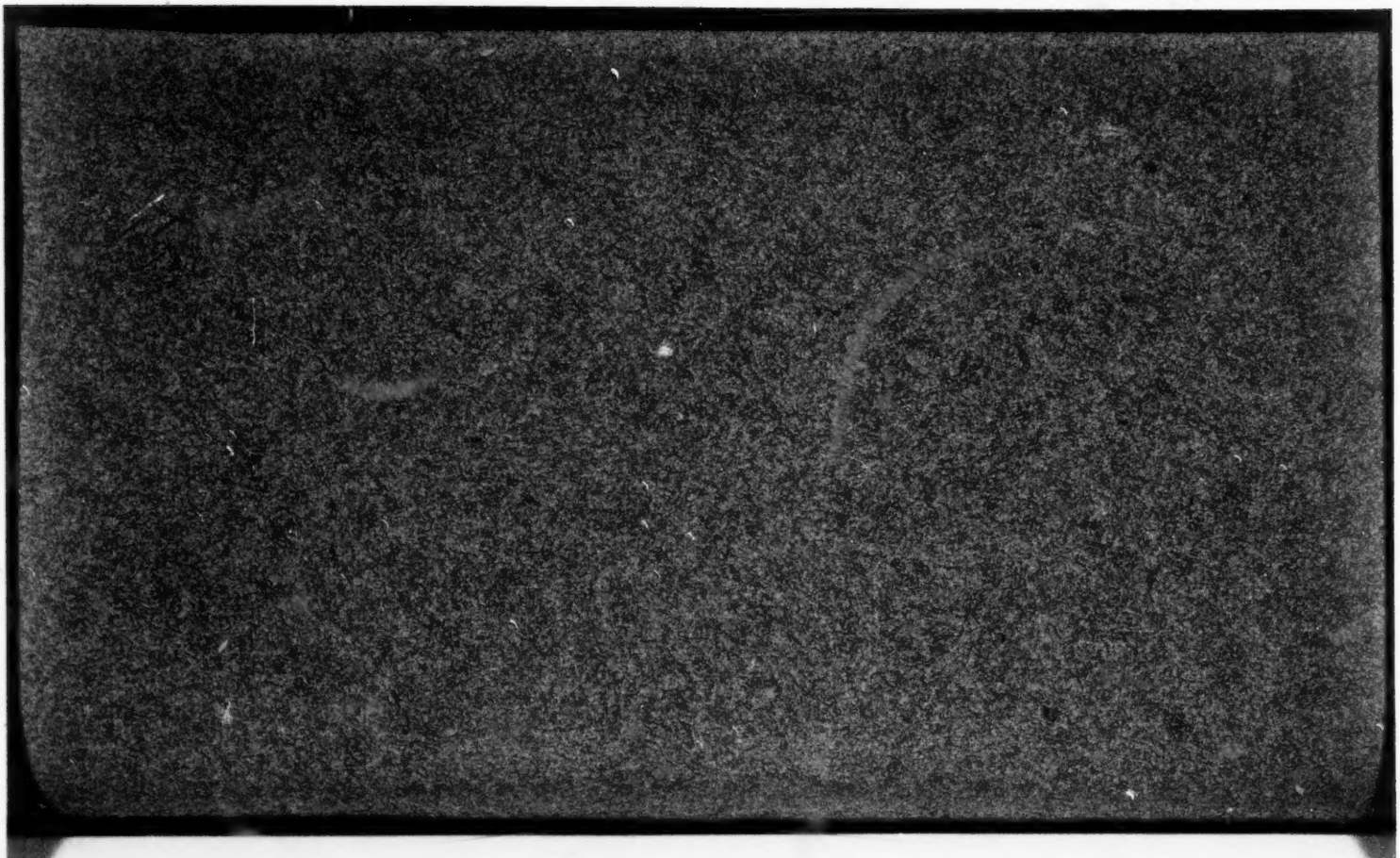
(5.) Judge TOWNSEND said in his opinion:

"No reason is perceived why, if the Government desires to secure uniformity and accuracy, it should not take its tests or provide that they should be taken at the temperature at which its instruments are standardized" (123 Fed. Rep., 327).

This is what the importers wish. It is what in effect was recommended by the International Commission at Paris after Dr. Wiley, the principal expert for the Government, and Dr. Wiechmann, the expert for the importers, had discussed the subject at length. Dr. Wiley probably opposes because the Commission would not accept his correction scheme.

If such a plan as Judge TOWNSEND suggests and the importers wish were adopted, no table of corrections would be required. The results would be the same irrespective of the changes of temperature.





IN THE

Supreme Court of the United States.

AMERICAN SUGAR REFINING COMPANY OF NEW YORK, Appellant, vs. THE UNITED STATES, Respondent.	October Term, 1908. (No. 3.) Reply Brief for Appellant on Question of Jurisdiction.

APPEAL FROM THE CIRCUIT COURT OF THE UNITED STATES FOR THE SOUTHERN DISTRICT OF NEW YORK.

The brief for the Government asserts that in this appeal "the only real substantial point involved is whether or not he [the Secretary of the Treasury] properly construed the statute, and that gives this Court no jurisdiction upon direct appeal (*Sloan* v. *U. S.*, 193 U. S., 614, 620; *Beaver* v. *Haubert*, 198 U. S., 77, 85)."

This statement involves two propositions:

(1) That the case at bar presents only the question of the proper construction of a statute; and

(2) That where only the proper construction of a statute is presented this Court has no jurisdiction upon direct appeal from the Circuit Court.

1. No authority is needed to support the latter proposition. Neither of the cases cited supports the first.

The *Beavers* case (198 U. S., 77, 85), has no bearing upon either proposition. It was a *habeas corpus* case; and the appeals from the Circuit Court and the District Court were not dismissed but their orders were affirmed. The *Sloan* case (193 U. S., 614, 620), is an authority only for the second proposition, which is not disputed. It was a direct appeal from the Circuit Court, taken on the ground that the construction of a treaty with the Omaha Indians had been drawn in question. The Court held that as the rights of the parties concededly depended solely upon the proper construction not of the treaty but of a subsequent Act of Congress, the language of the treaty being referred to only as an argument in support of the construction of the act contended for by the appellant, the validity or construction of the treaty was not drawn in question. The case would be pertinent if the appellant were contending that the General Appraisers in classifying these sugars should have construed the Act of Congress in harmony with a previous treaty with Cuba.

2. The question presented by the case at bar is not, as maintained by the Government, one of the proper construction of the Tariff Act at all.

On the contrary, the complaint of the appellant is that there has been *no* construction of the Tariff Act, either by the General Appraisers or by the Circuit Court; but, instead, an assessment of duties upon the sugars in question under a mere Treasury regulation; and that by this Treasury regulation the Secretary of the Treasury has undertaken to usurp the power of Congress to enact a Tariff Bill and the power of the General Appraisers and of the Courts to construe it, and himself to prescribe the rate and the amount of duty which must be imposed.

The contention of the Government, stated baldly, is that if the Secretary of the Treasury chooses by

Treasury regulation to double or quadruple the duty actually imposed by the Act of Congress and at the same time to take shelter behind the plea that in so doing he has only been "construing" the Act, no wrong has been done to the importer which this Court has the power to redress. If this be sound, the executive branch of the Government can strip the legislative branch of its function of enacting laws, and the judicial branch of its function of construing them; and yet no rights secured to the citizen by the Federal Constitution be infringed. Precisely this seems to be asserted in the Government's brief:

> "It may not be doubted that Congress, without violating any constitutional provision, could have in terms directed exactly what was prescribed by the Treasury regulations. If, attempting to act under the statute, executive officers have imposed an unauthorized burden upon appellant, no constitutional rights have been violated; there has been at most a misconstruction of the law. (*South Carolina* v. *Seymour*, 153 U. S., 353, 358; *Linford* v. *Ellison*, 155 U. S., 303, 308; *Rawlins* v. *Georgia*, 201 U. S., 638; *Matter of Moran*, 203 U. S., 96, 104.)"

3. It is impossible *a priori* that these or any other cases can sustain this proposition. They do not.

(*a*). In *South Carolina* v. *Seymour* the State attempted to compel the Commissioner of Patents by mandamus to register a trademark for distilled liquors which it claimed to own. The Commissioner had refused to register it, on the ground that the State did not own or have the right to use the trademark. The Court of Appeals of the District of Columbia had held that the duties imposed by the Trademark Act upon the Commissioner "were not ministerial, but required the exercise of judgment and discretion by the Commissioner," and that, therefore, this exercise of judgment could not be controlled by mandamus. This Court said:

> "It is quite clear that there was not 'drawn in question the validity of a treaty or statute

> of or an authority exercised under the United States.' In order to come within this clause the validity and not the construction only of a treaty or statute of the United States or of an authority exercised under the United States, must be directly drawn in question. * * * The only controversy was as to the construction of the Act of Congress, and consequently as to the nature and extent of the Commissioner's authority. Neither the question whether the Commissioner rightly decided upon the presumptive lawfulness of the right of the State of South Carolina to the trademark sought to be registered, nor the question whether the Commissioner's duty was of such a character that a writ of mandamus would lie to compel its performance, would involve a question of the validity of the authority exercised by him under the United States."

Clearly, this case does not hold that where, as in the case at bar, the validity of a Treasury regulation imposing a duty upon imported merchandise, in addition to that fixed by the Act of Congress, is directly challenged, the question is not presented to this Court for review.

(*b*). *Linford* v. *Ellison* was a case in which the Supreme Court of the Territory of Utah had held a tax invalid upon the ground that under the territorial Act a municipal corporation could not tax for municipal purposes farming lands outside the platted portion of the city. This Court said:

> "It is thus seen that the decision of the Supreme Court of the Territory involved the construction of the organic law and the scope of the authority to legislate conferred upon the territorial legislature; but that the validity of that authority and of the statute was not drawn in question."

The case has no application to the question here presented.

(*c*). *Rawlins* v. *Georgia* was a writ of error to the Supreme Court of Georgia, prosecuted upon the

ground that a criminal on his trial in the State Court had been deprived of rights guaranteed to him by the Fourteenth Amendment. The writ was not dismissed, but the judgment was affirmed; and the case is no way in point.

(*d*). *Matter of Moran* was a direct application to this Court for a writ of habeas corpus in a criminal case. Of course the question whether the construction or application of the Constitution of the United States was so far involved as to justify a writ of error was not and could not have been considered; but only the question of the jurisdiction of the Trial Court.

4. No case cited, therefore, supports the Government's proposition, that where the validity of Treasury regulations is attacked as an illegal exercise of power lodged with another branch of the Government, a federal question is not presented to this Court for review. None could be; for there are at least two recent decisions by this Court which hold the exact contrary.

Boske v. *Comingore* (177 U. S., 459):

This case is briefly referred to in the appellant's main brief (p. 44). There a United States Collector of Internal Revenue had refused to produce before a State court certain of his records, basing his refusal upon a Treasury regulation as follows:

> "All records in the offices of Collectors of Internal Revenue or of any of their deputies, are in their custody and control for purposes relating to the collection of revenues of the United States only. They have no control of them and no discretion with regard to permitting the use of them for any other purpose."

Notwithstanding this regulation, the State Court had imprisoned the Collector for contempt of court in refusing to produce the records. Thereafter in *habeas corpus* proceedings before the United States Dis-

trict Court for the District of Kentucky, he was discharged upon the ground that the Treasury regulation in question was valid and justified the alleged contempt. Thereupon the prosecuting officers of the State, asserting, like the appellant here, the invalidity of the Treasury regulation, took a direct appeal to this Court from the order of the District Court discharging the prisoner. In this Court the Attorney-General, on behalf of the appellee, took the same objection to the jurisdiction of this Court that he takes in the case at bar. This Court said (p. 465):

> "Throughout, the contention of the appellant [the prosecuting officers of Kentucky] has been that the Constitution forbade the giving of the force of law to those regulations adopted by merely executive officers. We think the case is properly here on appeal as one involving the construction and application of the Constitution of the United States."

UNITED STATES *v.* STEINMETZ, 192 U. S., 543:

The Commissioner of Patents, upon the authority of one of the regulations made in the office, had refused to allow an inventor to take a certain appeal to the Examiners-in-Chief. The inventor, asserting the invalidity of the rule, applied to the Supreme Court of the District of Columbia for a mandamus to the Commissioner of Patents to compel him to allow the appeal. In that Court his petition was dismissed, and the order dismissing it was affirmed in the Court of Appeals for the District. The inventor then appealed to this Court. The Attorney-General, appearing on behalf of the Commissioner of Patents made this point precisely as in the case at bar (192 U. S., 553):

> "The validity of an authority exercised under the United States is not here drawn in question; and this Court has no jurisdiction. *Baltimore & Potomac R. R. Co.* v. *Hopkins*, 132 U. S., 210; *U. S.* v. *Lynch*, 137 U. S., 280;

South Carolina v. *Seymour*, 153 U. S., 353, 358; *Linford* v. *Ellison*, 155 U. S., 503, 508."

This Court said (p. 505):

> "The jurisdiction of this Court to review the judgment of the Court of Appeals is questioned. There is no money in dispute, nor anything to which a pecuniary value has been given. Jurisdiction is claimed under the clause of Section 8 of the Act of February 9, 1893, which gives an appeal to this Court from the final judgment or decree of the Court of Appeals in cases in which there is drawn in question the validity of 'an authority exercised under the United States.' By Section 485 of the Revised Statutes the Commissioner of Patents, subject to the approval of the Secretary of the Interior, is empowered to establish from time to time regulations not inconsistent with law for the conduct of proceedings in the Patent Office. The Commissioner of Patents, exercising the power conferred, established, among other rules of practice, Rule 41. It thereby became a rule of procedure and constituted, in part, the powers of the primary examiner and commissioner. In other words, it became an authority to those officers and necessarily an authority 'under the United States.' Its validity was and is assailed by the plaintiff in error. We think, therefore, we have jurisdiction, and the motion to dismiss is denied."

It is true that the Act of 1893, establishing the Court of Appeals of the District of Columbia, defines a case appealable to the Supreme Court of the United States as one "in which is drawn in question the validity of a treaty or statute or of an authority exercised under the United States"; and that the language of the Evarts Act is somewhat different: — "Any case that involves the construction or application of the Constitution of the United States." But a case in which is challenged the validity of a department regulation as an unlawful exercise of powers confided by the Constitution to Congress

alone, would appear to be included under the language of each Act; and in the *Comingore* case, *supra*, which was an appeal under the Evarts Act the Court seems to have so held when it said:

> "Throughout, the contention of the appellant has been that the Constitution forbade the giving of the force of law to those regulations adopted by merely executive officers. We think the case is properly here on appeal as one involving the construction and application of the Constitution of the United States."

5. That the validity of the Treasury regulation in question was directly challenged in the Circuit Court and is directly challenged here, cannot be questioned. From the petition for review to the Circuit Court we quote the following:

> "Your petitioner, being dissatisfied with the decisions assessing duties as aforesaid, gave notice in each case within ten days after said liquidation and ascertainment of duty, setting forth the reason of its objection thereto in each case, to wit, that the so-called and pretended polariscopic tests upon which the said liquidations were based were in each case the polariscopic tests of the sugar, increased in each case by certain additions made there to in pursuance only of certain regulations promulgated by the Secretary of the Treasury on October 27th, 1897, and again on February 17th, 1899, *which regulations, in so far as they require the making of such additions, are illegal and void and contrary to the laws and the Constitution of the United States.* * * *
>
> And for errors of law * * * your petitioner states that the said Board were in error:
>
> 1. In not holding * * * that such addition was, and is, therefore, the imposition of an additional tax on said sugars, by the Secretary of the Treasury, in violation of the provisions of the Statutes and Constitution of the United States" (p. 3). * * *

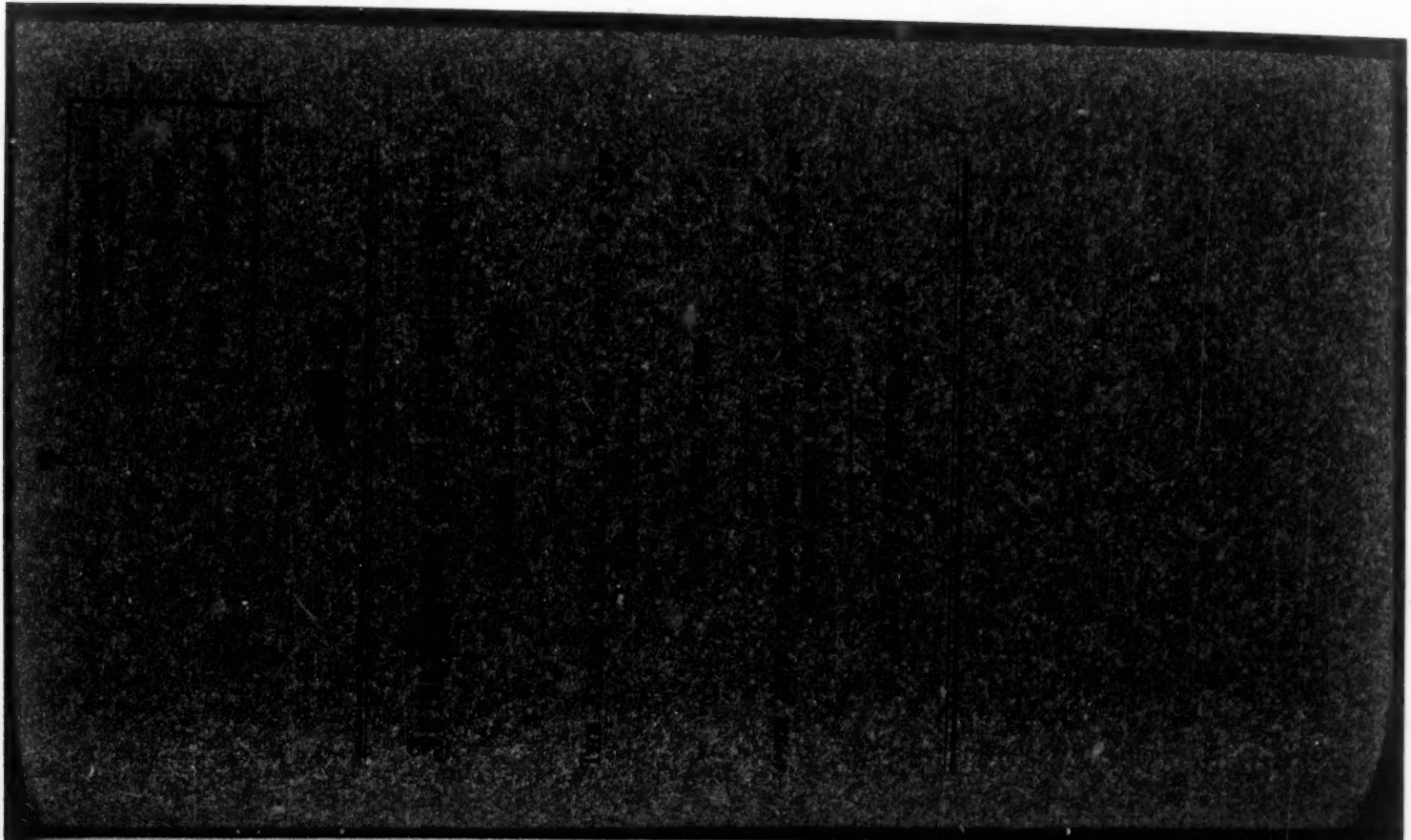
IX.—In holding that the regulations promulgated by the Secretary of the Treasury under date of October 27th, 1897, or the revised regulations promulgated by him under date of February 17th, 1899, in conformity with which such sugars were tested, are reasonable regulations or are authorized by the laws or Constitution of the United States."

The assignment of errors (Nos. 3 and 11) in this Court repeats *verbatim* the above language (Record, pp. 693, 695).

The objection of the Government to the jurisdiction of this Court to hear this appeal is not well taken, and should be overruled.

Respectfully submitted,

H. B. Closson,
John G. Johnson,
John E. Parsons,
Of Counsel for Appellant.



In the Supreme Court of the United States.

OCTOBER TERM, 1907.

THE AMERICAN SUGAR REFINING COMPANY of New York, appellant, *v.* THE UNITED STATES. } No. 25.

APPEAL FROM THE CIRCUIT COURT OF THE UNITED STATES FOR THE SOUTHERN DISTRICT OF NEW YORK.

BRIEF FOR THE UNITED STATES.

I.

Statement.

This direct appeal from the circuit court is an attempt, by suggesting a constitutional question which I submit can not be regarded as substantial, to secure a reconsideration of matters arising under the revenue laws determined by the Circuit Court of Appeals at New York in *United States* v. *Bartram Bros.*, *United States* v. *Howell*, and *United States* v. *The American Sugar Refining Co.* (131 Fed. Rep., 833), and wherein a petition for certiorari was presented to this court and denied, December 5, 1904 (195 U. S., 635).

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The tariff act of July 24, 1897, provides:

> Par. 209. Sugars not above number sixteen Dutch standard in color, tank bottoms, sirups of cane juice, melada, concentrated melada, concrete and concentrated molasses, testing by the polariscope not above seventy-five degrees, ninety-five one-hundredths of one cent per pound, and for every additional degree shown by the polariscopic test, thirty-five one-thousandths of one cent per pound additional, and fractions of a degree in proportion; and on sugar above number sixteen Dutch standard in color, and on all sugar which has gone through a process of refining, one cent and ninety-five one-hundredths of one cent per pound; molasses testing above forty degrees and not above fifty-six degrees, three cents per gallon; testing fifty-six degrees and above, six cents per gallon; sugar drainings and sugar sweepings shall be subject to duty as molasses or sugar, as the case may be, according to polariscopic test: * * *

In October, 1897, the Treasury Department issued general regulations (modified 1899, in ways immaterial here; R., 317–329) governing sampling and classification of sugars under the above quoted paragraph (R., 295–310), which, among other things, declared:

> The expression "testing * * * degrees by the polariscope," occurring in the act, is construed to mean the percentage of pure sucrose contained in the sugar as ascertained by polarimetric estimation. (R., 310.)

They further stated (R., 312–313), that changes of temperature affect the indications of a polari-

scope, and to determine by means of it true sucrose contents apparent readings must be corrected as shown by a table accompanying each instrument and embodying the results of careful experiments therewith; when the thermometer is above 17.5° Centigrade, the point of standardization, additions must be made; when below, corresponding subtractions.

The interpretation of the statute and validity of the regulations were at once challenged by importers, who claimed that the reading of a polariscope is not affected by change in temperature; and, further, that the term "polariscopic test" in the tariff act of 1897, according to its well-settled commercial use, as well as by the language itself, requires testing only in the way theretofore observed by merchants, and forbids any correction of the result observed by the eye. These contentions were denied by the collector.

The importers appealed to the Board of General Appraisers, and in March, 1899, their protest was overruled in a well-considered opinion (G. A. 4386) annexed hereto as Appendix 2.

Under the titles *Bartram Bros.* v. *United States*, *Howell* v. *United States*, and *The American Sugar Refining Company* v. *United States* appeal was taken to the Circuit Court, Southern District of New York. (Decided May 4, 1903, 123 Fed. Rep., 327.) That court reversed the judgment of the General Appraisers, holding that the term "testing by the polariscope" had a well-settled commercial meaning prior

to 1897, and must be interpreted according thereto. It declared, however (p. 329), the preponderance of proof sustained the contention "that there is a variation in the reading of the polariscope, according to variations in temperature at the place where the sugar is tested, and that the corrections and additions provided for by the regulations merely consist in an addition of .3 per cent for each 10 degrees Centigrade of temperature above that at which the polariscope is standardized, and that in this way the actual amount of pure sucrose in each sample is more accurately determined than was the case under the old eye test."

The Circuit Court of Appeals (131 Fed. Rep., 833) reversed the Circuit Court and sustained the General Appraisers. It held Congress intended there should be a scientific determination, by means of the polariscope, of sucrose contents, and that the method prescribed by the Treasury regulations was proper in order to secure the desired result.

At the October term, 1904, an elaborate petition for a writ of certiorari to bring up the cases for review was presented to this court, and denied (195 U. S., 635).

In the present cause (R. 19) counsel stipulated:

> It is agreed that the sugars in question were tested and classified in accordance with the Treasury regulations of October 27, 1897, and of February 17, 1899, *and that the questions raised are the same as those in the cases of Joseph E. Bartram and others* v. *The United States, Benjamin H. Howell and others* v. *The*

United States, and The American Sugar Refining Company v. *The United States reported in 123 Fed. Rep., 327, and in 131 Fed. Rep., 833,* and it is agreed that the evidence and exhibits in those cases contained on pages 33 to 364, inclusive, and pages 373 to 734, inclusive, of the transcript of record in those cases prepared for the Supreme Court of the United States and contained in the volume filed herewith * * * are to be treated as duly taken and introduced as evidence in this cause.

II.

The Court is without jurisdiction, and the appeal should be dismissed.

Judiciary act, March 3, 1891 (26 Stat., 827):

SEC. 5. That appeals or writs of error may be taken from the district courts or from the existing circuit courts direct to the Supreme Court in the following cases:

In any case in which the jurisdiction of the court is in issue; in such cases the question of jurisdiction alone shall be certified to the Supreme Court from the court below for decision.

From the final sentences and decrees in prize causes.

In cases of conviction of a capital or otherwise infamous crime.

In any case that involves the construction or application of the Constitution of the United States.

In any case in which the constitutionality of any law of the United States, or the validity

> or construction of any treaty made under its authority, is drawn in question.
>
> In any case in which the constitution or law of a State is claimed to be in contravention of the Constitution of the United States.
>
> Nothing in this act shall affect the jurisdiction of the Supreme Court in cases appealed from the highest court of a State, nor the construction of the statute providing for review of such cases.

The present appeal is direct from the Circuit Court and can not be entertained unless the construction or application of the Constitution of the United States is involved. Upon that ground alone counsel for appellant attempt to support the jurisdiction. (Appellant's brief, pp. 8, 44.) They say (p. 44): "If the Treasury regulations are invalid, it is because in assuming to add something to the dutiable standard prescribed by the tariff act, they constitute an exercise by the executive branch of the Government of legislative power which by the Constitution has been confided solely to Congress."

The pertinent assignments of error (R. 694, 695) follow:

> 3. The Circuit Court erred in not holding that the addition to the number of degrees shown by the polariscopic test of said sugars of a certain percentage as a so-called correction for temperature was and is, in addition to the polariscopic test prescribed by the act of Congress, known as the tariff act of July 24, 1897; and in not holding that such addition was and

is, therefore, the imposition of an additional tax on said sugars by the Secretary of the Treasury in violation of the provisions of the statutes and Constitution of the United States.

* * * * *

11. The Circuit Court erred in holding that the regulations promulgated by the Secretary of the Treasury under date of October 27, 1897, or the revised regulations promulgated by him under date of February 17, 1899, in conformity with which such sugars were tested, are reasonable regulations or are authorized by the laws or Constitution of the United States, in so far as they require additions to be made to the observed polariscopic test of sugar or prescribe a polariscopic test different in any way from that heretofore and then and now in use by the trade and prescribed both by the Treasury regulations of May 13, 1895, which regulations were in force at the time of the passage of the tariff act in question, and the Treasury regulations promulgated by the Treasury Department under date of May 22, 1883, under the tariff act of March 3, 1883.

A mere allegation that some constitutional question is involved does not suffice to give jurisdiction; the record must show a real, substantial dispute or controversy concerning the construction or application of the Constitution upon which the result depends. (*Western Union Telegraph Co.* v. *Ann Arbor R. R. Co.*, 178 U. S., 239, 243; *Lampasas* v. *Bell*, 180 U. S., 276; *American Sugar Refining Co.* v. *New Orleans*, 181 U. S., 277, 281.) No such dispute or controversy exists.

The admitted duty of the Secretary of the Treasury was to construe as best he could the paragraph relating to collection of duty upon sugars, and to promulgate regulations for carrying it into effect. (Rev. Stat., sec. 251.) This and this alone he did. The only real substantial point involved is whether or not he properly construed the statute, and that gives this court no jurisdiction upon direct appeal. (*Sloan* v. *United States*, 193 U. S., 614, 620; *Beavers* v. *Haubert*, 198 U. S., 77, 85.)

It may not be doubted that Congress, without violating any constitutional provision, could have in terms directed exactly what was prescribed by the Treasury regulations. If, attempting to act under the statute, executive officers have imposed an unauthorized burden upon appellant, no constitutional rights have been violated; there has been at most a misconstruction of the law. (*South Carolina* v. *Seymour*, 153 U. S., 353, 358; *Linford* v. *Ellison*, 155 U. S., 503, 508; *Rawlins* v. *Georgia*, 201 U. S., 638; *Matter of Moran*, 203 U. S., 96, 104.)

Manifestly, if the construction or application of the Constitution of the United States within the meaning of section 5, act of 1891, is involved in every case where one claims according to his interpretation of a statute excessive duty or tax has been demanded by executive officers, the provisions of that act making decisions of the Circuit Court of Appeals in revenue cases final are of very limited value, and this court must entertain direct appeals from the Circuit Courts in most tariff and tax controversies.

III.

The history of the Government's use of the polariscope for testing sugars and of the regulations therefor makes the meaning of the term "polariscopic test" reasonably clear.

The tariff act of July 24, 1897 (30 Stat., 151, 168), provides:

> Par. 209. Sugars not above number sixteen Dutch standard in color, * * * testing by the polariscope not above seventy-five degrees, ninety-five one-hundredths of one cent per pound, and for every additional degree shown by the polariscopic test, thirty-five one-thousandths of one cent per pound additional, and fractions of a degree in proportion; and on sugar above number sixteen Dutch standard in color, and on all sugar which has gone through a process of refining, one cent and ninety-five one-hundredths of one cent per pound; molasses testing above forty degrees and not above fifty-six degrees, three cents per gallon; testing fifty-six degrees and above, six cents per gallon; sugar drainings and sugar sweepings shall be subject to duty as molasses or sugar, as the case may be, according to polariscopic test. * * *

The tariff act of March 3, 1883 (22 Stat., 488, 502), provided:

> All sugars not above No. 13 Dutch standard in color shall pay duty on their polariscopic test as follows, viz:
>
> All sugars not above No. 13 Dutch standard in color, * * * and concentrated molasses, testing by the polariscope not above seventy-

five degrees, shall pay a duty of one and forty-hundredths cents per pound, and for every additional degree or fraction of a degree shown by the polariscopic test, they shall pay four-hundredths of a cent per pound additional.

* * * * *

Molasses testing not above fifty-six degrees by the polariscope shall pay a duty of four cents per gallon, molasses testing above fifty-six degrees shall pay a duty of eight cents per gallon.

The tariff act of October 1, 1890 (26 Stat., 567, 583), provided:

Par. 231. * * * There shall be paid * * * to the producer of sugar testing not less than ninety degrees by the polariscope, from beets, sorghum, or sugar-cane grown within the United States, or from maple sap produced within the United States, a bounty of two cents per pound; and upon such sugar testing less than ninety degrees by the polariscope, and not less than eighty degrees, a bounty of one and three-fourths cents per pound, under such rules and regulations as the Commissioner of Internal Revenue, with the approval of the Secretary of the Treasury, shall prescribe.

Par. 237. All sugars above number sixteen Dutch standard in color shall pay a duty of five-tenths of one cent per pound. * * *

Par. 726. (Free list.) Sugars, all not above number sixteen Dutch standard in color, all tank bottoms, all sugar drainings and sugar sweepings, sirups of cane juice, melada, concentrated melada, and concrete and concentrated molasses, and molasses.

The tariff act of August 27, 1894 (28 Stat., 509, 521), provided:

> Par. 182½. There shall be levied, collected, and paid on all sugars * * * a duty of forty per centum ad valorem, and upon all sugars above number sixteen Dutch standard in color, and upon all sugars which have been discolored there shall be levied, collected, and paid a duty of one-eighth of one cent per pound in addition to the said duty of forty per centum ad valorem. * * * That there shall be levied, collected, and paid on molasses testing above forty degrees and not above fifty-six degrees polariscope, a duty of two cents per gallon; if testing above fifty-six degrees polariscope, a duty of four cents per gallon.

It will be observed, under the tariff act of 1890 all sugars below 16 Dutch standard—the vast bulk of the importations—were admitted free, and those above that standard were dutiable at five-tenths of 1 cent per pound. Under this act, no polariscopic test of imported sugar for the purpose of ascertaining rates or amount of duty was necessary.

Under the act of 1894 the duty rate upon sugars did not depend upon the polariscope, and no test by it was necessary in order to fix the same.

The tariff act of 1890 (par. 231) provided for paying the producer a bounty of 2 cents per pound upon sugar testing not less than 90 degrees by the polariscope, and 1¾ cents per pound upon sugar testing between 80 and 90 degrees, under regulations to be

prescribed by the Commissioner of Internal Revenue, with the approval of the Secretary of the Treasury. In order to frame proper rules for carrying this provision into effect a commission was appointed in 1890 consisting of Doctor Wiley, chief chemist of the Department of Agriculture, Mr. Crampton, chemist of the Internal Revenue office, and Mr. Tittman, of the Coast and Geodetic Survey. (R., 113, 371.)

A series of experiments by Mr. Tittman shortly after the passage of the act of 1890 developed the fact that apparent readings of the polariscope vary inversely with the rise and fall of temperature; and that with an instrument standardized at 17.5° C., accurate results could only be reached by adding to apparent readings 0.03 of a degree (polariscopic scale) for each degree of temperature (Centigrade) above, and subtracting the same amount for each degree below that point. (R., 371.)

Acting upon recommendation of the commission, the Treasury Department issued regulations touching payments of bounty under the act of 1890. (R., 175 *et seq.*) The following is taken therefrom:

> (R., 187.) It will be necessary under the law to classify the sugar for payment of the bounty according to the polariscopic test. * * * In passing through the solution the ray is deviated in proportion to the amount of pure sugar which the solution contains. This instrument measures the deviation of the ray upon a scale of 100 degrees. When sugar tests 80 degrees, it is eight-tenths pure sugar. There will be no bounty upon any sugar which

does not contain 80 per cent of sucrose or pure sugar.

(R., 213.) The expression "testing * * * degrees by the polariscope" occurring in paragraph 231 of the act is construed to mean the percentage of pure sucrose contained in the sugar as ascertained by polarimetric estimation. Until further notice the degree of the "Ventzke scale," as hereinafter defined, will be considered as indicating the correct percentage of sucrose in the form of instrument used by this office in testing sugar. * * *

The following directions for the use of the polariscope in testing sugar are based upon the recommendations in a report made to the Commissioner of Internal Revenue by a commission consisting of the chemist of Internal Revenue, the chief chemist of the Department of Agriculture, and the assistant in charge of Weights and Measures. * * *

(R., 215.) The "setting" of the zero having been performed as above, the determination of the accurate adjustment of the instrument by means of the "control" quartz plates is proceeded with. Such a plate will be furnished with each polariscope having a sugar value which varies with the temperature, and tables are furnished each which give its exact value at different temperatures from 10° to 35° C.

Under those regulations the Government paid out large sums in bounties upon domestic sugars prior to the passage of the act of 1894. They were a practical, well-known interpretation of the term "polariscopic test" of sugar.

The regulations prescribed by the Treasury Department for carrying into effect the tariff act of 1897 as to the polariscopic test of sugars were based upon the report of a commission consisting of Doctor Wiley, chief chemist of the Department of Agriculture, Doctor Cramption, chemist of the Internal Revenue, and Mr. Braid, of the office of Weights and Measures, *and are substantially the same as those promulgated under the act of 1890.* It is important to observe that they are not based alone on theoretical considerations, but upon actual observations and determining thereby for *each* instrument the corrections which will give the true sugar contents at any temperature within ordinary variations. All instruments are tested by the office of Standard Weights and Measures. (R., 328.)

When the act of 1897 was passed Congress, of course, knew the practical construction of "tested by the polariscope" by the Treasury Department and must have used the words in the light of such interpretation by the executive officer under whose direction the act was to be made effective. That officer had stated in the clearest way what the term meant and had paid out large sums according to such definition. When Congress used the same words in reference to the same subject and directed the same officer to execute the law, it expected him to interpret them in the same way.

IV.

The phrases "testing by the polariscope" and "shown by the polariscopic test" were not used in the tariff act as peculiar commercial or trade terms.

The use of the polariscope is well described in Appendix 1 hereto, taken from a brief in the Circuit Court of Appeals prepared by Assistant United States Attorney Baker.

The record fails to support the contention that the terms "testing by the polariscope" and "polariscopic test" had a special trade meaning settled by uniform and well-established custom which requires acceptance of a particular practice of merchants. The Board of General Appraisers and the Circuit Court of Appeals found against such trade meaning. The polariscope is a scientific instrument devised to determine sucrose contents, not used by merchants but by experts for the purpose of arriving at correct results, not fallacious ones; and for some years before the tariff act of 1897 the executive branch of the Government, as above shown, practically interpreted the meaning of the terms in a way wholly inconsistent with appellant's theory.

The purpose for which the polariscope exists is to determine the sucrose contents of a solution, and the only apparent reason for its use is to arrive with facility at a substantially correct determination. Because an instrument, in the absence of careful and painstaking observations, may for some years have been so used as to produce inaccurate results, does

not appear a very strong reason for refusing to correct observations in order to obtain results more nearly in harmony with fact. All the tribunals below found that the Treasury regulations secure a more nearly accurate ascertainment of sucrose contents than the so-called eye test alone.

V.

The contention that the phrases "testing by the polariscope" and "polariscopic test" necessarily require the apparent reading of the instrument to be accepted as final is without merit.

The importers are contending that although the apparent readings of a polariscope unquestionably vary inversely and materially with the rise and fall of temperature, nevertheless under the tariff act of 1897 duties upon sugar must be assessed strictly according to the number of degrees which that instrument indicates to the eye, without considering temperature. In other words, in hot weather sugar must be classed too low; if frigid temperature prevails the classification must be too high; and sugar imported at New Orleans must be classed lower than if brought to Boston. In the beginning of this litigation they stoutly maintained temperature did not affect readings of the polariscope; but the proof annihilated that claim, and all the lower tribunals have so found.

The standard yard measure is a certain metal rod at 63° F., which grows longer as the temperature rises and shorter as it falls. If a bolt of cloth should be measured with the standard yard rod, the thermome-

ter being at 100°, the apparent length of the goods would be less than the real, and to arrive at an accurate result, proper additions, ascertained by experiment, would be necessary. A claim that the test by measurement under such circumstances was finished and terminated before the corrections were made would be obviously without merit; and surely no one could seriously contend that applying them was no part of the test. Temperature materially affects readings of the polariscope; and a test by it can no more be final without allowing for such influence than in the suggested case of measurement by the standard yard rod.

The official polariscope prescribed by the Secretary of the Treasury is made by Schmidt & Haensch, of Berlin, and standardized at 17.5° C. (63.5 F.)—about the average temperature in a German laboratory. The observed reading of a polariscope at the temperature of standardization accurately indicates the sucrose matter in the sample (R., 391, 392), but at no other point is this true. This seems to be substantially admitted in the brief for appellant. (Br., pp. 20, 26.)

As the thermometer in an American laboratory may vary from zero to 100° F., it is impracticable to have a separate instrument for each degree; and to bring the laboratory by artificial means to the same temperature for every experiment would be likewise entirely impracticable. The Secretary solved the difficulty when he submitted every instrument to

experts who prepared tables showing the precise variations of each one, and directed that apparent readings be modified accordingly. In this way he has secured practically the same result which would have been attained by providing instruments standardized at each degree, or by bringing the laboratory to the same temperature for every test. And he has secured uniformity of duties at all ports, irrespective of their prevailing temperatures, in harmony with the requirements of the Constitution. The tariff act does not prescribe the use of any particular polariscope, and says nothing about the temperature for standardization. These and similar questions were left for executive determination.

The brief for appellant (p. 69) admits that it would be entirely proper for the Secretary of the Treasury to prescribe an instrument standardized at the temperature prevailing at time of test, or that he might direct all testing at the temperature of standardization. Neither of these things is practicable in actual operation; to provide 50 or 100 instruments—one for each degree—in every laboratory is quite out of the question; and to bring the laboratory to one temperature for every test would be immensely expensive if not indeed impossible. The regulations have in a practical way overcome the difficulties.

The complaint of the importers arises because the laboratory is generally above 63.5° F. (for which the instruments in use are standardized), and something

is added to apparent readings. As the tariff act prescribes no point for standardization, that might have been placed at, say, 100° F.—much above the ordinary temperature—and then in the absence of proper allowances for excessive readings complaint, loud and just, would certainly have come.

It is maintained that, because polariscopic tests have shown some sugars to contain more than 100° of sucrose matter, the whole system must be radically wrong. But if the polariscope were used at a temperature much below the point of standardization, as appellant admits could be lawfully done, apparent readings might still more frequently show sucrose matter in excess of 100°, and objectionable "chemical impossibilities" increase. Nothing in the statute prescribes the point of standardization or the temperature at which the test shall be made. Duties assessed upon sugars strictly according to apparent readings, under regulations in harmony with what appellant admits the Treasury could lawfully prescribe, might therefore be in excess of those now imposed.

The record discloses (pp. 94, 136–137) very satisfactory reasons why the existence of sucrose matter exceeding 100° is sometimes indicated. Certain allowances must be made for the observer—the personal equation. The regulations (R., 312) recognize this. The eye is not infallible; it sees differently at different times, and no two individuals see exactly alike. A substance known as raffinose is not infre-

quently found in beet sugars, and a trace of it has a perceptible effect upon the rotation of a polarized ray. The Treasury method is more accurate than the one importers contend for, and approach to accuracy is all that can be expected.

I respectfully ask that the appeal be dismissed. If such action is not permissible I ask that the judgment of the Circuit Court be affirmed.

JAMES C. MCREYNOLDS,

Special Assistant to the Attorney-General.

November, 1907.

APPENDIX 1.

THE POLARISCOPE.

The instruments used in the sugar laboratory at the United States Appraisers stores were made in Berlin, Germany, by the celebrated makers, Schmidt & Haensch. They represent the highest scientific development of the polariscope. All scales, flasks, tables, quartz plates, and utensils used by the appraising officers in making polariscope tests are tested, examined, and standardized, and kept in perfect condition by the Office of Weights and Measures of the United States Coast and Geodetic Survey.

The polariscope is an instrument by which rays of light are changed when passing through trianguiar shaped pieces of crystal (Iceland spar is employed in the instruments in question, in a form known as the "Nicoll prism") from a spherical mass or bundle of rays (the form in which they impinge or fall upon the surface of the prism) into a thin, flat form resembling a narrow strip of paper, as they emerge from the opposite angle of the prism. The rays which find their way through the prism are but a portion of the number that in the first instance entered the opposite angle of the prism. Most of the rays are refracted and diverted. Such are known as the ordinary rays, while those that may pass through, emerging in the thin, flat form, are known as the *extraordinary rays*, and are said to be *polarized*.

When this polarized ray passes through certain solutions of crystalline substances it is more or less twisted or deflected to the right or left of the perpendicular position it possessed when it left the prism.

A solution of sugar possesses this power of twisting or deflecting the polarized ray, and the more crystals of sugar or the larger percentage of sucrose in the solution the more the ray is twisted or deflected, and contra. Such twisting or deflection is known as the *rotation of the ray*. The distance the ray is twisted or deflected is indicated in the polariscope by a scale of degrees, known as the Ventzke scale, placed in the instrument. This scale is placed on the edges of two thin quartz wedges, one of which moves back and forth by means of a milled head, increasing or decreasing as it is moved to the right or left, respectively, the total thickness of the two wedges. By a nice adjustment of these two wedges the polarized ray is twisted back to its original position as it came from the prism, or, in other words, the tortion or twisting is compensated, and the amount of compensation is the amount indicated on the Ventzke scale of the instrument as the degrees of the polariscope. The degrees marked on this Ventzke scale in the instrument are the degrees referred to in the statute.

The polariscopes used by the United States are constructed and adjusted, "standardized," as the term is, to be employed at a temperature of 17.5° C.; that is, the temperature of the room of sugar solution and of the instrument is to be 17.5° C., or 63.5° of Fahrenheit.

The scale is graduated from 1 to 100 degrees. A solution of sugar containing no foreign substances, being what is called substantially pure sugar, reads on the Ventzke scale on the polariscope, other conditions being complied with, at a temperature of 17.5° C., 100 degrees. *The polariscope indicates the amount or percentage of sucrose or sugar crystals contained in a given quantity of sugar.*

In making the polariscopic tests the instrument is first examined to determine whether it is in proper

adjustment or not, by placing in the trough or tube of the instrument a quartz or control plate which has the same rotary power as the polarized ray in the sugar solution. If the instrument is in apparent perfect adjustment the plate is then removed and a metal tube twenty millimeters in length, previously filled with a solution of the sugar to be tested, is placed in a trough or tube of the instrument and the polarized ray is allowed to pass through the solution longitudinally, each end of the tube being fitted with a glass cap to permit the passage of the ray. The milled head is turned back and forth by the observer until the field in the instrument is suffused with a uniform tint, instead of being sharply divided into two or three different shades, as shown in the illustrations on pages 482 and 486 of the record. The scale is then read, five or six readings being made in succession of the same solution, and the average of the readings is taken as the correct reading, subject to the corrections above pointed out.

If the temperature shown by the thermometer is above 17.5° C., an addition of 0.3 one degree of the polariscope is made to the reading for every ten degrees above 17.5° C., or a subtraction is made in the same ratio if the temperature is below 17.5° C. These corrections for differences in temperature are made from tables carefully prepared by the Office of Weights and Measures of the Coast and Geodetic Survey (an illustration of the manner of making the corrections is shown at page 485 of the record).

This correction for differences in temperature, when an instrument standardized at a given temperature is used at different temperatures, is the only step in the method of making the tests that is questioned by the importers.

APPENDIX 2.

(20850—G. A. 4386.)

Polariscopic test of sugar.

The regulations of the Secretary of the Treasury of October 27, 1897 (Synopsis 18508), prescribing that a particular polariscopic test, made by special apparatus, shall determine the classification of imported sugars, in place of the former "commercial" test, are not unreasonable or violative of any provision of law.—It seems that the "commercial test" was adopted for arriving at market value rather than for purposes of classification.—The phrases "testing by the polariscope" and "degrees shown by the polariscope," as used in paragraph 209 of the tariff act of 1897, have no peculiar trade meaning, but are used descriptively, in their ordinary signification, as indicating a true polariscopic test.

Before the U. S. General Appraisers at New York, March 11, 1899.

In the matter of the protests, 31180*f*, etc., of Bartram Bros. *et al.*, against the decision of the collector of customs at New York, N. Y., as to the rate and amount of duties chargeable on certain merchandise, imported per the vessels and entered on the dates named in the schedule.

Opinion by SOMERVILLE, *General Appraiser*.

The importations consist of sugars of the particular description shown by the several reports of the local appraiser, which were classified and assessed for duty according to the polariscopic tests reported by the appraiser under paragraph 209 of the sugar schedule of the tariff act of July 24, 1897, which reads as follows, the proviso being omitted as having no bearing on the questions under consideration:

209. Sugars not above number sixteen Dutch standard in color, tank bottoms, sirups of cane juice, melada, concentrated melada, concrete and

concentrated molasses, *testing by the polariscope* not above seventy-five degrees, ninety-five one-hundredths of one cent per pound, and for *every additional degree shown by the polariscopic test*, thirty-five one-thousandths of one cent per pound additional, and fractions of a degree in proportion; and on sugar above number sixteen Dutch standard in color, and on all sugar which has gone through a process of refining, one cent and ninety-five one-hundredths of one cent per pound; molasses testing above forty degrees and not above fifty-six degrees, three cents per gallon; testing fifty-six degrees and above, six cents per gallon; sugar drainings and sugar sweepings shall be subject to duty as molasses or sugar, as the case may be, according to polariscopic test:

For the enforcement of these provisions, the Secretary of the Treasury, on October 27, 1897, issued certain "Regulations for the sampling and classification of imported sugars and molasses," published as Treasury Synopsis 18508. These regulations provide, not only for a method of sampling sugars, but for the standardization and adjustment of apparatus and instruments used in the work of testing sugar by the polariscope, including polariscopes, weights, flasks, polariscope tubes, and quartz plates. Minute instructions are given relative to the use of the polariscope and other details, to which attention will hereafter be directed.

These regulations are admitted to be founded on, but amendatory of, similar regulations issued by the Department May 22, 1883 (Treasury Synopses 5725 and 6859), Treasury Circular No. 62, which were designed to carry into effect the sugar schedule, paragraphs 235 *et seq.* of the tariff act of March 3, 1883, wherein sugars were made dutiable according to polariscopic test.

Other regulations were issued and approved by the Department, prescribed by the Commissioner of Internal Revenue, for the purpose of enforcing paragraph 231, sugar schedule, of the tariff act of October 1, 1890, providing for certain bounties on domestic sugar, according to specified tests by the polariscope, known as "Regulations relative to bounty on sugar of domestic production," dated August 18, 1892.

The various methods prescribed by the regulations of October 27, 1897 (Synopsis 18508), which were followed by the customs officials in classifying the sugars under consideration, do not differ in any essential particular from the methods prescribed under the bounty regulations issued under the tariff act of 1890, to which we have above referred.

The contentions made by the importers may be briefly summarized as follows:

(1) That the tests of these sugars as returned by the appraiser are erroneous and excessive, owing to an incorrect method of testing the same by the polariscope, as prescribed by the regulations of the Treasury Department in question.

(2) That the phrase used in said paragraph 209, "testing by the polariscope," must be construed to mean the usual commercial polariscopic test, as recognized and accepted in trade between buyers and sellers of sugar at and prior to the adoption of the tariff act of 1897.

It is a matter of common knowledge, and is corroborated by the testimony in these cases, that the polariscope (an instrument for polarizing light and testing its properties) has been used to determine the percentage of pure sugar in any given sample without regard to its color or condition. The sugar to be tested is weighed with great care and dissolved in

an exact volume of water, usually contained in a flask, and a ray of polarized light is then passed through the solution. In its passage, the ray is deflected in proportion to the amount of sucrose in the solution, the deviation being measured upon a scale of 100 degrees, the number of degrees indicating the percentage of pure sugar.

We deem it needless to discuss elaborately all the minute differences in the various Treasury regulations above mentioned. Many of them are, confessedly, immaterial and unexceptionable; and, save those mentioned in briefs of counsel, none seem to deserve serious consideration.

In reference to the so-called commercial test, contended for as correct by the importers' counsel, the testimony taken at the hearing satisfactorily shows the following facts:

During the time the tariff acts of 1883 and 1894 were in force, it was the custom of merchants, in buying and selling sugar, to have two separate polariscopic tests made, each by a trade chemist employed by the respective parties to the transaction. Where these two tests differed, a compromise or "settlement" test was adopted, which was the average of degrees shown by the two tests.

In like manner, the regulations of 1883, paragraphs 30 and 31, provided for a classification based on the average of tests made by two or more experts in the appraiser's office; as much as three-tenths of 1 per cent being sometimes eliminated as an allowance for possible errors of observation.

Of course, the trade system was adopted for the purpose of arriving at *the market value of sugars, rather than for purposes of classification*. The system was also used by Government officials during the

continuance of the tariff act of 1894, which provided no polariscopic test for classification purposes, sugar being dutiable at 40 per cent *ad valorem*, with certain specified exceptions subject to additional specific rates.

The testimony utterly fails to show any peculiar trade meaning attaching to the phrases "testing by the polariscope" or "degrees shown by the polariscope," as used in paragraph 209 of the tariff act of 1897. These phrases are, manifestly, used descriptively, in their ordinary signification. As stated in paragraph 79 of Department regulations for 1897, the expression "testing * * * degrees by the polariscope" means merely "the percentage of pure sucrose contained in the sugar, as ascertained by polarimetric estimation," or, in other words, by a correct polariscopic test, as nearly as can be arrived at by proper scientific methods.

The doctrine of commercial designation, as settled by the courts, has no bearing on the subject, and refers merely to the denomination of imported merchandise subject to duty under tariff legislation. The rule is that the subjects or classes of subjects described in the schedules of a tariff act are understood to be used by Congress in their special commercial or trade meanings, if the trade is shown to attach to them a signification different from their meaning in ordinary speech. (Dennison Manufacturing Company *v.* United States, 72 Fed. Rep., 258; 18 C. C. A. Rep., 543, note on pp. 545–9, citing numerous court decisions.)

The importers' contention, then, resolves itself into this: That in using the phrase "testing by the polariscope" Congress referred to a particular system which had prevailed in the trade for twenty-five

years or more, used in ascertaining *market values* of sugars dependent on actual sales by merchants rather than to a true polariscopic test by improved instruments and advanced scientific methods designed to determine classification rather than *market value.* All things considered, it is more reasonable to believe that Congress referred to the polariscopic tests adopted by the Government for determining the distribution of sugar bounties under the tariff act of 1890—which are not materially different from the test method prescribed by the regulations of 1897—than to any so-called commercial test or any test authorized by the regulations of 1883, in the days of inferior instruments and less scientific methods. This view is strengthened by the fact that the Government now uses the polariscope known as the "half-shadow" apparatus, the latest invention of science in this department, in place of what was known as the "tint" instrument formerly in use. The former is shown to be, probably, more accurate than any other instrument of the kind in use. A flask for holding the sugar solutions known as the "true cubic centimeter flask" has been substituted for the older "Mohr" flask formerly used.

These facts are pertinent, in view of the importers' contention that the system of sugar tests under the present regulations is not so accurate as the former system, leading to erroneous results, prejudicial to their interests, and that the Secretary's regulations authorizing such system are unauthorized by law.

The Secretary of the Treasury is authorized by section 251 of the Revised Statutes to adopt such reasonable rules and regulations as are "not inconsistent with law," and are designed for the convenient administration of customs laws, but he can not, in the exer-

cise of this power, alter or amend the provisions of the revenue laws. He is empowered, however, "to regulate the mode of proceeding to carry into effect what Congress has enacted." (Morrill *v.* Jones, 106 U. S., 467; *in re* Goodsell, G. A. 3880, affirmed by the Circuit Court, 84 Fed. Rep., 155, and by the Circuit Court of Appeals, Second Circuit, suit 2616, January 5, 1899, decision not published).

Various reasons are assigned in support of the contention of the importers that the regulations of 1897 are unreasonable to such an extent as to work a change in the law resulting in the exaction of excessive duties, instead of merely carrying into effect the intent of Congress.

The first objection is the substitution of the "true cubic centimeter flask" for the "Mohr" flask.

The "Mohr" flask holds 100 grams of pure distilled water, when filled to a designated mark, at a temperature of 17.5 C. The "true cubic centimeter flask" is graduated to contain 100.06 true cubic centimeters.

The testimony shows that the latter apparatus has been approved by the Office of Standard Weights and Measures of the Coast and Geodetic Survey, a body of reputable scientists, which is the lawful authority in the United States on the subject of weights and measures. It has also been approved by the Second International Congress of Applied Chemistry, which met in Paris in 1897 and at Vienna in 1898, and was composed of delegates from all the leading nationalities in the world. The use of an instrument indorsed by such high authorities would seem not unreasonable, independently of the fact—sustained as we think, by the testimony before us—that the volume of the flask has no effect on the polarization

of the solution, provided such volume be accurately known and calculations made accordingly.

The second objection, and one relied on as more vital than any other, is the fact that the present regulations (paragraphs 82 and 88) make an allowance, in the reading of the polariscope, for a variation of 0.2 from the established values on account of "errors of observation, temperature, etc."

The importers urge that when the sugar solution is prepared at the same temperature at which it is polarized the temperature makes no appreciable difference in the result; and several experts of large experience so testify. On the contrary, the Government maintains that temperature *does* very appreciably affect the specific rotatory power of sugar, and, therefore, is a factor not to be neglected.

In spite of much conflicting testimony on this point, we think the weight of the evidence satisfactorily supports the contention of the Government. The testimony of Dr. Harvey W. Wiley, chief chemist of the Department of Agriculture at Washington and a recognized scientific authority, shows a degree of research and investigation on this subject which seems more satisfactory and exhaustive than that of any other witness. He states that, for the special purpose of ascertaining what influence temperature variations exerted upon the polarization of different sugar solutions, he made more than twelve hundred polarizations at different temperatures, the character and nature of which are fully set out in the record, with a tabulated statement of results. These experiments fully justified the views expressed by the witness, and induced him to abandon a contrary opinion which he had formerly expressed in a work of which he was the

author, published in the year 1897, called The Principles and Practice of Agricultural Analysis, vol. 3, Agricultural Products. Several other scientific authorities are shown to agree with him on this particular subject.

Weighing all the testimony, and viewing it in every aspect in which it can be legally considered, we see nothing unreasonable in the variation allowed by the regulations, based on the factor of temperature, certainly none which, in our judgment, would authorize this Board or the courts to pronounce this feature of the regulations illegal or violative of any provision of law.

In addition to the above objections some others were urged, but they are not sustained by the testimony, and are not of sufficient importance to require particular discussion.

In conclusion, we must note one fact of great importance as showing that, under the regulations of 1897, results have been reached as to sugar tests far more accurate and uniform than any attained under previous methods. It appears that, under the old regulations and the commercial method, there was an ascertained difference of six-tenths of 1 per cent, on an average, between tests made at the port of New York and those made at Boston and Philadelphia, the three chief sugar ports of the country. This was demonstrated by an exchange of tests made at the different ports, from identical samples, the experiments continuing from day to day for over six months. Under the new regulations, this difference is shown to have been reduced to about 0.1, or one-sixth of what it was under the old system. This is probably due, in part, to the fact that all the apparatus used for testing sugar, including polari-

scopes, weights, flasks, tubes, and quartz plates are now required to be standardized and their accuracy attested by the Office of Standard Weights and Measures, United States Coast and Geodetic Survey, in conformity to the requirements of paragraph 77 of these regulations. Naturally, this leads to more uniform results, and is an improvement on the former practice.

Another reason for such result would seem to be the more accurate instruments and improved methods of use now in vogue, as well as the correction of former errors shown by continued observation and experiments.

There remains but one other point to be specially considered. It is shown that, under the new regulations, chemically pure or refined sugars sometimes test over 100 degrees by the polariscope, reaching as much as 100 and two or three tenths in addition. Of course, the practice of customs officials is to reject all such additional readings as errors authorized to be disregarded, and this fact is urged as a demonstration of the inaccuracy of the new system. Our judgment is that while this fact may demonstrate the want of mathematical accuracy in sugar tests, it may be satisfactorily accounted for on one or more of the following grounds:

First, there may be errors of observation in reading the scale, which runs to fractions of degrees, and which requires great accuracy. The present regulations, accordingly, make an allowance, as stated above, of two-tenths of 1 per cent for errors of observation, temperature, etc. The former regulations made an allowance of three-tenths of 1 per cent "to eliminate the possible errors of observation."

Secondly, the flask holding the solution may contain too little water and slightly too much sugar, thus making the solution more concentrated, and causing too high a polarization.

Thirdly, the presence of traces of "raffinose" in the sugar would account for such a result. "Raffinose" is defined as a colorless crystalline compound, represented by the chemical formula $C_{18}H_{32}O_{16}5H_2O$, the scale on the instrument, which is designed only to polarize sucrose, the essential element of sugar, would thus indicate a higher polarization by reason of the presence of this "raffinose."

In the light of the evidence taken at the hearing these explanations seem not unreasonable. It is admitted on all sides that mathematical accuracy is not attainable by any such process. There is, therefore, room for the application of the legal maxim, "*De minimis non curat lex.*"

In cases of this kind, moreover, the settled rule is that the burden of proof is not on the Government to show that the collector's classification is correct, but the presumption is in favor of its correctness, and the burden is upon the importer to show that it is not correct. (United States *v.* Rosenwald, 67 Fed. Rep., 323, 14 C. C. A. Rep., 399; Arthur *v.* Unkhart, 96 U. S., 118, 122; Hills *v.* Erhardt, 59 Fed. Rep., 769.) In our opinion, this burden of proof has not been successfully sustained by the importers, and their protests are accordingly overruled, the collector's decision being affirmed in each case.

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